Emerging Markets : global Excess Liquidity, Portfolio Capital Flows and Asset Prices

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THÈSE DE DOCTORAT
de l'Université de recherche
Paris Sciences et Lettres –
PSL Research University

préparée à l'Université
Paris – Dauphine

Marchés Émergents : Excès de Liquidité Mondiale, Investissements de Portefeuille et Prix des Actifs

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Ecole doctorale n°543
Spécialité : Sciences de gestion
Soutenue le 18.03.2016

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Remerciements

L'élaboration de ce travail de recherche n'aurait pas été possible sans la collaboration de nombreuses personnes que je tiens à remercier au travers de ces quelques lignes.

Je tiens à exprimer mes premiers remerciements à ma directrice de thèse, Madame Gaëlle Le Fol. Pendant ces trois années de recherche, elle a su se rendre disponible et est restée attentive malgré ses nombreuses charges. Son expérience, sa rigueur et sa clairvoyance m'ont beaucoup appris. Ses encouragements et ses conseils, toujours distillés à bon escient, ont su me motiver quant à la rédaction de cette présente thèse mais aussi quant à la présentation de mes articles de recherche dans différentes conférences à travers le monde.

Je tiens à adresser mes remerciements les plus sincères à mon tuteur de thèse chez Amundi Asset Management, Monsieur Didier Borowski. Pendant ces quatre années passées au sein du département Stratégie et Recherche Economique, il m'a accordé sa confiance et a toujours su rester disponible et à l'écoute de mes moindres interrogations. La thèse qui suit lui doit beaucoup et je ne saurais lui montrer toute la gratitude et la reconnaissance que j'ai pour lui.

J'exprime tous mes remerciements à l'ensemble des membres de mon jury : Mesdames Sophie Brana et Mardi Dungey en qualité de rapporteurs, Madame Marie Brière et Monsieur Roland Straub en qualité d'examinateurs.

J'adresse des remerciements particuliers au Directeur du département Recherche, Stratégie et Analyse, Monsieur Philipe Ithurbide, pour la confiance qu'il m'a accordée, pour sa bienveillance et pour ses conseils. Je tiens à le remercier pour ses qualités aussi bien professionnelles qu'humaines.

Merci à l'ensemble de l'équipe du département Stratégie et Recherche Economique qui m'a chaleureusement accueilli et apporté son expertise tout au long de ces quatre années passées à leurs côtés. Merci à Anne-Charlotte, Karine, Valentine, Catherine, Sosi, Delphine, Pia, Amel, Helena, Bernadette, Bastien, Rémy, Hassan, Tristan, Eric, Ibra, Marc-Ali, Nicolas et Benoit.

Merci aux professeurs et doctorants du laboratoire DRM-Finance de l'Université Paris-

Dauphine de m'avoir permis de réaliser cette thèse dans de bonnes conditions. Les conférences auxquelles j'ai pu assister au sein du laboratoire ont toujours été de grande qualité et très formatrices.

Merci aussi à tous mes amis qu'ils viennent du sud-est de la France, de la région parisienne ou d'ailleurs. J'ai toujours pu compter sur eux dans les moments importants de ma vie et ils ont été une source intarissable d'inspiration pour mes travaux de recherche.

Mes remerciements ainsi que toute mon affection vont bien évidemment à ma famille. Maman, c'est vers toi que vont mes plus profondes pensées. Ta présence, ton expérience, ton amour inconditionnel ont su me guider à travers les grandes étapes de la vie. Tes nombreuses relectures, souvent dans l'urgence, ont fait de toi une experte en sciences économiques. Papa, Nicolas, Christine, Sheila, Marie-Christine, Christol, Pierre, Pascale, Albane, Aurélien, Laura, Cambyse, Kyan, vos encouragements, votre confiance, votre tendresse me portent tous les jours. Merci d'avoir fait de moi ce que je suis aujourd'hui.

Enfin, mes derniers remerciements vont à ma femme, Florie-Anne. Depuis de nombreuses années, elle a su m'épauler, me conseiller, me guider, me supporter, m'aimer. Même si ma femme est un sujet de recherche plus passionnant encore que l'excès de liquidité mondiale, la présente thèse ne lui est pas consacrée mais dans tout ce que je fais, il y a toujours un peu d'elle... Est-ce un bon endroit pour dire ce genre de choses ? Je n'en connais en tout cas pas de mauvais. Je t'aime.

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ADF	Augmented Dickey-Fuller
BIS	Bank for International Settlements
BoE	Bank of England
BoJ	Bank of Japan
BoP	Balance of Payments
BPM6	Sixth Edition of the Balance of Payments and International Investment Position Manual
BRICS	Brazil, Russia, India, China and South Africa
BRIC	Brazil, Russia, India and China
BSADF	Backward Sup(remum) Augmented Dickey-Fuller
CESI	Citigroup Economic Surprise Index
CGFS	Committee on the Global Financial System
CRB	Commodity Research Bureau
DM	Developed Market
ECB	European Central Bank
ECM	Error Correction Model
EMBI	Emerging Markets Bond Index
EM	Emerging Market
EPFR	Emerging Portfolio Fund Research
Fed	Federal Reserve
GBI	Global Bond Index
GDP	Gross Domestic Product
GSADF	Generalised Sup(remum) Augmented Dickey-Fuller
GSCI	Goldman Sachs Commodity Index
IMF	International Monetary Fund
IPS	Im, Pesaran and Shin
IRF	Impulse Response Function

LLC	Levin, Lin and Chu
LMEX	London Metal Exchange Index
MAE	Mean Absolute Error
MBIC	Modified Bayesian Information Crtierion
MdAPE	Median Absolute Percentage Error
MSCI	Morgan Stanley Capital International
NEER	Nominal Effective Exchange Rate
NRMSE	Normalised Root Mean Square Error
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
P/B	Price-to-Book
P/D	Price-to-Dividend
P/E	Price-to-Earnings
PBoC	People's Bank of China
PDOLS	Panel Dynamic Ordinary Least Squares
PPP	Purchasing Power Parity
PP	Phillips-Perron
PSY	Phillips, Shi and Yu
QE	Quantitative Easing
REER	Real Effective Exchange Rate
RMSE	Root Mean Square Error
SADF	Sup(remum) Augmented Dickey-Fuller
VAR	Vector AutoRegressive
VEC	Vector Error Correction
ZIRP	Zero Interest Rate Policy

Introduction Générale

En octobre 2012, Christine Lagarde, actuelle présidente du Fonds Monétaire International (FMI), se prononce sur les effets, potentiellement dévastateurs, des politiques monétaires accommodantes menées par les Marchés Développés (MD) à l'égard des Marchés Émergents[1] (ME) :

> *"Accommodative monetary policies in many advanced economies are likely to spur large and volatile capital flows to emerging economies. This could strain the capacity of these economies to absorb the potentially large flows and could lead to overheating, asset price bubbles, and the build-up of financial imbalances.*[2]*"*

Ces propos illustrent le caractère potentiellement dangereux des politiques monétaires non conventionnelles mises en place par les grandes banques centrales des MD, Réserve Fédérale (Fed) en tête, vis-à-vis de la stabilité économique et financière des ME. En effet, à la suite de la crise financière mondiale de 2007-08 et la « Grande Récession » qui a suivi[3], l'excès de liquidité mondiale, au sens monétaire du terme (BRI, CGFS, 2011), résultant notamment de l'assouplissement drastique des politiques monétaires des MD ne s'est pas traduit par un retour de l'inflation des biens et services à l'échelle mondiale mais plutôt par un accroissement significatif de la taille des flux de capitaux, notamment vers les ME. Cet excès de liquidité mondiale, visible au bilan des principales banques centrales des MD, a eu pour effet, entre autres, une forte hausse des prix des actifs

[1] La notion de marché émergent est, dans la suite de cette thèse, identique à celle de pays émergent ou d'économie émergente. Nous utilisons le terme « marché » plutôt que celui de « pays » ou d'« économie ». Il en est de même en ce qui concerne les marchés développés.

[2] Discours d'ouverture prononcé par Christine Lagarde lors du meeting annuel du FMI et de la Banque Mondiale à Tokyo en octobre 2012.

[3] La crise financière mondiale de 2007-08 et la « Grande Récession » se produisent de manière presque concomitante. La crise financière voit le jour aux États-Unis avec la crise dite des subprimes à partir de juillet 2007. La faillite de Lehman Brothers en septembre 2008 donne une dimension internationale à la crise financière en contaminant l'ensemble du système bancaire mondial. L'aggravation de cette crise financière précipite une récession mondiale qualifiée de « Grande Récession » par analogie avec la « Grande Dépression » des années 1930. Cependant, la « Grande Récession » trouve en réalité ses racines dans les niveaux de dette extrêmement élevés à l'échelle mondiale qui se sont accumulés au cours des décennies antérieures. Pour plus de détails sur ce qu'il s'est passé durant la cise financière mondiale, *cf.* Gorton et Metrick (2012).

des ME. En outre, la part des flux de capitaux au titre des investissements de portefeuille s'est accrue (Fratzscher *et al.*, 2012). Même si cet essor des investissements de portefeuille est généralement profitable pour les ME, en pratique, le caractère volatil de ces investissements de portefeuille, *i.e.*, envolées (*surges*) et/ou arrêts brutaux (*sudden stops*), est source de déséquilibres macroéconomiques et financiers dans les ME. L'étude de ces investissements de portefeuille est donc devenue un thème central que ce soit pour les décideurs politiques ou pour l'industrie de la gestion d'actifs (FMI, 2007 et 2011a ; Magud *et al.*, 2011 ; Forbes et Warnock, 2012). Dans ce contexte d'excès de liquidité mondiale et de taux d'intérêt réels historiquement bas, les investisseurs internationaux ont commencé à rechercher du rendement ailleurs que sur les marchés obligataires. C'est donc à travers cette dynamique de recherche de rendement que ces investissements de portefeuille se sont déversés sur les ME, *i.e.*, *push factors* (Fratzscher, 2012), au premier rang desquels figurent les marchés d'actions émergents, marchés sur lesquels de potentielles bulles[4] ont pu faire leur apparition dans l'ère post-Lehman (Sidaoui *et al.*, 2011).

De l'ère post-Lehman à la « Nouvelle Normale » : un contexte propice à l'excès de liquidité mondiale

Cette thèse a pour objectif l'étude des effets potentiels de l'excès de liquidité mondiale sur les prix des actifs des ME, notamment *via* le canal des investissements de portefeuille. Depuis la crise financière mondiale de 2007-08 et la « Grande Récession » qui a suivi, la reprise économique a été lente et s'est accompagnée de pressions déflationnistes déstabilisantes. En réponse à ce marasme économique et financier, les principales banques centrales des MD, *i.e.*, Fed, Banque d'Angleterre (BoE), Banque du Japon (BoJ) et Banque Centrale Européenne (BCE), ont considérablement assoupli leurs politiques monétaires. Dans un premier temps et en accord avec leurs objectifs de stabilité des prix, elles ont abaissé rapidement leurs taux d'intérêt directeurs jusqu'à atteindre le voisinage de zéro. Dans un second temps, devant l'impuissance des politiques monétaires conventionnelles à ramener l'inflation vers des territoires plus

[4]Généralement, une bulle (spéculative) se définit comme un écart important et persistant du prix d'un actif par rapport à sa valeur fondamentale. Cette définition implique qu'il existe un modèle permettant de déterminer le prix fondamental d'un actif, même si celui-ci n'est généralement pas directement observable. La formation d'une bulle repose sur le fait que des anticipations auto-réalisatrices peuvent conduire les prix d'un actif à s'éloigner de leurs valeurs fondamentales, sans que cette divergence soit directement détectable. Deux types de bulles coexistent : les bulles « rationnelles » et, par opposition, les bulles « irrationnelles ». Dans le troisième chapitre, nous nous concentrons sur les bulles rationnelles et utilisons la méthodologie proposée par Phillips *et al.* (2013a et 2013b).

soutenables et afin d'éviter un potentiel cercle vicieux de déflation par la dette[5], les principales banques centrales des MD ont, tour à tour, eu recours à des politiques monétaires non conventionnelles[6], au premier rang desquelles figurent les vagues successives d'assouplissement quantitatif (*quantitative easing* ou *QE*). L'ensemble de ces politiques monétaires très accommodantes et non conventionnelles ont eu, au début de l'ère post-Lehman, des conséquences positives et bien accueillies par les investisseurs internationaux, ces derniers ayant pu y voir un processus de normalisation des prix des actifs alors très fortement sous-évalués. En effet, peu après le lancement de la première vague d'assouplissement quantitatif initiée par la Fed en novembre 2008 (*QE 1*), les États-Unis ont vu leurs marchés d'actions rebondir très nettement. Cette envolée du prix des actions américaines s'est ensuite propagée à d'autres classes d'actifs puis à d'autres marchés financiers à travers le monde, dont les ME.

Dans le même temps, une autre conséquence visible de ces politiques monétaires non conventionnelles a été l'aggravation des pressions baissières sur les taux d'intérêt à court terme et la forte hausse de la base monétaire, *i.e.*, l'agrégat monétaire M0[7]. Aux États-Unis, dans le sillage du *QE 1*, comparé au mois d'octobre 2008, la base monétaire a bondi de 27% au mois de novembre 2008. Cette hausse a perduré pour atteindre un pic en août 2014 à près de 260% d'augmentation, toujours par rapport au mois d'octobre 2008. Cette très forte hausse de la base monétaire s'est évidemment transmise aux autres agrégats monétaires, plus larges, *i.e.*, M1, M2 et M3. Dès lors et à mesure que les principales banques centrales des MD ont mis en place des politiques monétaires non

[5] La théorie de la déflation par la dette (*debt deflation*) a été développée par Fisher (1933) et a été reprise plus récemment par Minsky (1992) et Bernanke (1995). Elle se définit comme le phénomène qui voit les agents économiques prendre conscience de leur fort niveau d'endettement, qu'ils remboursent en vendant leurs actifs. En se généralisant, ces ventes aboutissent à la baisse du prix des actifs, si bien que leur niveau d'endettement s'accroît relativement à la valeur des actifs. Les krachs boursiers de 1929 et de 1997 au Japon sont une illustration du phénomène de déflation par la dette.

[6] Lorsque les canaux de transmission conventionnels, *i.e.*, canal du taux d'intérêt et canal du crédit, présentent des dysfonctionnements et/ou semblent inappropriés quant à la poursuite des objectifs des banques centrales, ces dernières peuvent mettre en œuvre des politiques monétaires dites non conventionnelles. Ces politiques monétaires non conventionnelles sont, pour la majorité d'entre elles, un sous-produit de la crise financière de 2007-08 et de la « Grande Récession ». Trois grandes catégories de mesures se distinguent : (i) agir sur la pente de la courbe des taux en s'engageant sur la trajectoire future des taux directeurs de façon à orienter les anticipations des agents, *i.e.*, pilotage des anticipations (*forward guidance*) ; (ii) débloquer les marchés du crédit en achetant directement des titres sur ces marchés afin de peser sur les primes de risque, *i.e.*, assouplissement des conditions de crédit (*credit easing*) ; (iii) augmenter massivement la quantité de monnaie en circulation dans l'économie en achetant directement des titres financiers, *i.e.*, assouplissement quantitatif (*quantitative easing*). En outre, même si la frontière entre ces deux dernières catégories de mesures peut sembler poreuse, elles poursuivent les mêmes objectifs et sont de puissants outils pour lutter contre le phénomène de déflation par la dette. De plus, que ces mesures soient stérilisées ou non, elles génèrent indubitablement des effets de réallocation des portefeuilles.

[7] Les agrégats monétaires sont des indicateurs statistiques regroupant dans des ensembles homogènes les moyens de paiement détenus par les agents d'un territoire donné. L'agrégat M0, appelé aussi base monétaire ou monnaie banque centrale, représente l'ensemble des engagements monétaires d'une banque centrale, dont les billets et pièces en circulation. L'agrégat M1 représente les billets et pièces en circulation ainsi que les dépôts à vue. L'agrégat M2 représente M1 plus les dépôts à court terme (inférieurs à 2 ans). L'agrégat M3 représente M2 plus les dépôts à moyen et long terme (supérieurs à 2 ans) et les OPCVM monétaires.

conventionnelles, la masse monétaire, prise dans son ensemble, est devenue excessive comparée à la trajectoire de croissance du PIB mondial. En revanche, cet excès de liquidité mondiale ne s'est pas déversé directement dans la sphère réelle car l'expansion du crédit domestique a été beaucoup plus timide que celle de la masse monétaire. En effet, à l'échelle mondiale, la période de resserrement du crédit (*credit crunch*) qui a débuté en 2001 s'est atténuée à l'aube de l'annonce du lancement du *QE 1*. Cependant, l'effet d'annonce a été de courte durée et une nouvelle phase de découplage des trajectoires d'expansion du crédit domestique et de la masse monétaire s'est amorcée. Cette phase de désendettement (*deleveraging*) a contraint une nouvelle fois l'accès au crédit à l'échelle mondiale et a poussé l'excès de liquidité vers la sphère financière. De plus, il convient de noter qu'avant la crise financière mondiale de 2007-08 et la mise en place des politiques monétaires non conventionnelles, l'excès d'épargne mondiale (*global saving glut*, Bernanke, 2005), principalement en provenance des ME, est venu nourrir l'abondance de liquidité au niveau mondial *via* l'accumulation importante de réserves de change. En effet, pour ne citer qu'un seul chiffre montrant la démesure de cette accumulation de réserves de change de la part des ME, en l'espace de 20 ans, la Chine a multiplié par plus de 125 le montant de ses réserves de change pour atteindre plus de 4 000 milliards USD en juin 2014. Fin 2014, la Banque populaire de Chine (PBoC) a rejoint ses homologues développés en assouplissant de manière drastique sa politique monétaire afin de soutenir sa croissance, promouvoir l'expansion du crédit et encourager les investissements spéculatifs sur ses marchés boursiers, dopant à son tour l'excès de liquidité mondiale. Globalement, cet excès de liquidité mondiale a engendré une baisse significative des taux d'intérêt à long terme. Ce contexte de faiblesse historique des taux d'intérêt réels a encouragé les investisseurs internationaux à rechercher du rendement ailleurs que sur les marchés obligataires développés, les poussant à se tourner vers des actifs plus rémunérateurs et donc plus risqués (FMI, 2010b ; Matsumoto, 2011). Cet environnement a été qualifié pour la première fois de « Nouvelle Normale » par Mohamed A. El-Erian (2009) puis a été repris par la suite au sein du FMI en 2010 :

> *"We coined the term 'new normal' at PIMCO in early 2009 in the context of cautioning against the prevailing (and dominant) market and policy view that post crisis industrial economies would revert to their most recent means. Instead, our research suggested that economic (as opposed to financial) normalisation would be much more complex and uncertain – thus the two-part*

analogy of an uneven journey *and a* new destination.[8]*"*

Dans cette environnement qualifié donc de « Nouvelle Normale », l'excès de liquidité mondiale et la recherche de rendement qui en découle ont eu pour conséquences les plus visibles, une augmentation de la taille des flux de capitaux, investissements de portefeuille en tête, ainsi qu'une réallocation géographique de ces flux, notamment vers les ME.

Depuis le début des années 2000 et l'éclatement de la bulle internet, les flux de capitaux en provenance des MD ont eu tendance à se déverser par vagues sur les ME. Ce phénomène s'est intensifié après la crise financière mondiale de 2007-08. En effet, comparées aux vagues de flux de capitaux entrants pré-crise, les vagues récentes sont caractérisées par une part de plus en plus importante d'investissements de portefeuille. De plus, cet essor des investissements de portefeuille semble être un phénomène structurel qui implique une certaine volatilité, *i.e.*, envolées (*surges*) et/ou arrêts brutaux (*sudden stops*) (FMI, 2011a et 2011b ; Broner *et al.*, 2013), pouvant créer des déséquilibres macroéconomiques et financiers, particulièrement dans les ME :

"Excessive liquidity from the aggressive policy actions taken by the central banks to stabilize their domestic economies have been spilling over into emerging market economies, fostering excessive volatility in capital flows and commodity prices.[9]*"*

Ces risques sont principalement présents en Asie émergente ainsi qu'en Amérique latine (Kaminsky et Reinhart, 1999 ; Berthaud *et al.*, 2011 ; FMI, 2011b ; Ahmed et Zlate, 2013). En outre, la « Nouvelle Normale » implique que les politiques monétaires devraient rester très accommodantes à court terme, tout du moins dans les MD. Cependant, à long terme, le resserrement de ces mêmes politiques monétaires paraît inévitable alors que les perspectives de croissance économique dans les ME s'affaiblissent, exacerbant certains déséquilibres macroéconomiques et financiers[10]. Certains de ces déséquilibres se sont déjà manifestés dans les ME et continueront probablement de

[8] Discours prononcé par Mohamed A. El-Erian, alors Président Directeur Général de PIMCO, lors du Meeting annuel du FMI et de la Banque Mondiale à Washington en octobre 2010. Ce terme désigne une situation peu familière ou atypique qui est devenue la norme. Ce terme fait ici référence aux taux d'intérêt réels historiquement bas, à l'excès de liquidité mondiale et à la recherche de rendement des investisseurs internationaux qui en découle.

[9] Article 5 de la déclaration de Delhi lors du 4ème Sommet des BRICS à New Delhi en mars 2012.

[10] En mai 2013, Ben Bernanke, alors Président de la Fed, annonce la fin de la troisième vague d'assouplissement quantitatif (*QE 3*) lancée en septembre 2012. Cette volonté d'adopter une politique monétaire moins accommodante

se manifester, *e.g.*, crises de Balance des Paiements (BdP), crises sur le marché des changes, apparition de bulles sur les marchés d'actions, etc. Sur ce dernier point, les marchés d'actions émergents ont connu de très belles années et nous sommes en droit de nous demander si ces derniers sont correctement valorisés ou, au contraire, si leur valorisation est excessive, voire exubérante, menant ainsi à la formation de bulles. Cependant, de potentiels effets de réallocation des portefeuilles peuvent être à l'origine de valorisations d'équilibre plus élevées de ces mêmes marchés d'actions émergents.

Les marchés émergents : lieu de la prochaine crise ?

A ce jour, il n'existe pas de définition économique précise de ce qu'est un ME. Cette notion assez floue peut varier d'un auteur à un autre et d'une époque à une autre. La notion de ME, en opposition à celle de MD, est née dans les années 1980 avec le développement des marchés financiers dans les pays en développement. La première utilisation du terme « marché émergent » est attribuée au néerlandais Van Agtmael en 1981, alors qu'il était économiste au sein de la Société Financière Internationale, institution mondiale d'aide au développement, membre du Groupe de la Banque Mondiale. Il emploie ce terme pour faire référence aux pays en développement offrant des opportunités intéressantes pour les investisseurs des MD.

C'est donc au sein des pays en développement que sont apparus les premiers ME. A la fin des années 1970, le terme de « nouveaux pays industriels » désigne, dans un premier temps, les « quatre dragons » d'Asie que sont la Corée du Sud, Taïwan, Singapour et Hong Kong. Dans un second temps, les « tigres » d'Asie que sont la Thaïlande, les Philippines et la Malaisie s'ajoutent aux « quatre dragons » d'Asie. Dans les années 1980-1990, les « nouveaux pays industriels » laissent peu à peu place aux « marchés émergents » et de nouveaux pays entrent dans la course à l'émergence. C'est notamment le cas de la Chine, de l'Inde et de l'Indonésie en Asie mais aussi de pays d'Amérique latine comme le Brésil et l'Argentine. Au début des années 2000, O'Neill, alors économiste chez Goldman Sachs, propose de regrouper Brésil, Russie, Inde et Chine sous l'acronyme « BRIC ». Il évoque notamment la rapidité de développement et l'attractivité financière de ces économies en devenir. Par la suite, les dirigeants de

passera par des réductions progressives et graduelles du rythme des achats d'actifs (*Fed tapering*). En novembre 2014, la Fed met effectivement fin à son *QE 3* et c'est alors la question de la date de la première hausse des taux directeurs qui se pose. En novembre 2015, cette question demeure mais il est très probable que ce prochain cycle de resserrement de la politique monétaire américaine soit de plus faible amplitude et plus graduel que par le passé.

ces quatre ME décident de se rencontrer lors du premier sommet annuel des BRIC en 2009. Ce premier sommet témoigne d'une certaine institutionnalisation et participe ainsi à la formation d'une « nouvelle réalité géopolitique ». En 2011, lors du troisième sommet des BRIC qui a lieu en Chine, l'acronyme devient « BRICS » avec l'adhésion officielle de l'Afrique du Sud.

Bien que le groupe des ME ne constitue pas une entité bien définie et homogène, *i.e.*, leur évolution historique ainsi que leurs structures économiques et sociales sont différentes, nous pouvons toutefois lui reconnaître quelques critères communs. En effet, les ME se caractérisent par un fort potentiel de croissance, un PIB par habitant plus faible que leurs homologues développés mais en constante augmentation, une ouverture économique au reste du monde s'accompagnant systématiquement des flux de capitaux entrants, *i.e.*, investissements directs étrangers et investissements de portefeuille et enfin, des transformations structurelles et institutionnelles de grande ampleur. Ce phénomène d'émergence ou de convergence des ME vers les MD peut être relativement long mais peut aboutir à la migration d'un ME en MD. C'est pourquoi le groupe des ME n'est pas figé dans le temps, *e.g.*, les « quatre dragons » d'Asie sont désormais considérés comme des MD. Néanmoins, les migrations ne sont pas à sens unique, *e.g.*, selon la classification établie par les indices actions MSCI, la Grèce en a récemment fait les frais en passant du groupe des MD à celui des ME, notamment pour des considérations d'ordre financier.

Même si l'anémie de la croissance économique contemporaine peut contraindre le processus de convergence des ME vers les MD, l'hypothèse de stagnation séculaire[11] pourrait représenter une opportunité pour certains ME, comme la Chine, de passer d'un modèle de croissance basé essentiellement sur les exportations manufacturières et l'investissement à un modèle de croissance plus domestique, basé davantage sur la consommation et les services. Ceci étant, le poids des ME dans l'économie mondiale a crû fortement durant les dernières décennies. Selon le FMI, le poids relatif des ME et des marchés en développement dans le PIB mondial en Parité de Pouvoir d'Achat (PPA) devrait représenter plus de 60% en 2020 alors que cette part n'était que de 36% dans les années 1980[12]. Cette ascension des ME s'est parfois accompagnée d'instabilité économique et

[11] Hansen (1939) utilise pour la première fois la notion de stagnation séculaire pour désigner une situation dans laquelle la fin de la croissance démographique et du progrès technique conduisent à une période de croissance économique anémique. Plus récemment, cette notion a été reprise par Summers dans une conférence du FMI (2013) puis dans un livre écrit par Baldwin et Teulings (2014) pour caractériser le manque de vigueur de l'économie mondiale dans l'ère post-Lehman.

[12] La croissance du poids relatif des ME et des marchés en développement dans le PIB mondial en PPA ne s'est pas

financière, *e.g.*, la crise mexicaine en 1994, la crise asiatique en 1997-98, la crise russe en 1998, la crise argentine en 2001 ou encore les crises chinoises en 2007 et 2015, pour ne citer que les plus importantes. Comme le souligne Robert J. Shiller, certaines de ces crises ont pu revêtir un caractère contagieux, allant parfois jusqu'à déplacer des bulles d'un ME à un autre :

> *"The idea of a bubble is an idea about a contagion of ideas that is mediated by changes in market prices.*[13]*"*

D'un point de vue plus prospectif et étant donné la forte intégration financière qui accompagne l'essor des ME (Förster *et al.*, 2012), il y a fort à parier que la prochaine crise financière mondiale trouvera ses racines dans les déséquilibres économiques et financiers des ME.

L'excès de liquidité mondiale se déverse sur les marchés émergents : de la hausse des investissements de portefeuille à la création de bulles

Dans un premier temps, nous nous attachons à définir et à mesurer la notion d'excès de liquidité mondiale afin de mieux en appréhender son comportement et ses tendances. Une fois cette notion définie et mesurée, nous cherchons à savoir dans quelle mesure l'excès de liquidité mondiale a pu provoquer des mouvements sur les prix des actifs des ME et plus particulièrement au sein des BRICS. La plupart des études ont porté sur les MD et sur les effets de l'expansion monétaire sur la croissance du PIB, l'inflation des prix à la consommation, les taux d'intérêt à court terme ou encore les marchés d'actions (Baks et Kramer, 1999 ; Gouteron et Szpiro, 2005 ; Rüffer et Stracca, 2006 ; Giese et Tuxen, 2007 ; Sousa et Zaghini, 2007 et 2008 ; Belke *et al.*, 2010b). Par la suite, certains chercheurs ont élargi le cadre d'étude en incluant davantage d'actifs, *e.g.*, les marchés obligataires, les taux de change effectif réels, les matières premières ou encore l'immobilier (Sousa et Zaghini, 2008 ; Belke *et al.*, 2010a et 2013). Un courant de littérature plus récent a transposé cette question aux ME (Rüffer et Stracca, 2006 ; Hartelius *et al.*, 2008 ; Brana *et al.*, 2012). Afin d'analyser les liens entre l'excès de liquidité mondiale et les prix des actifs, nous utilisons, comme la majorité des chercheurs

faite de manière linéaire. En effet, la décennie 1980 est marquée par une forte stabilité du poids des ME dans l'économie mondiale. En 1992, la Russie devient membre du FMI et le poids des ME dans l'économie mondiale bondit de près de 5 points de pourcentage. Ce n'est qu'à partir du début des années 2000 que le poids des ME dans l'économie mondiale croît fortement, notamment à la suite de l'accession de la Chine à l'Organisation Mondiale du Commerce.

[13] Interview de Robert J. Shiller lors de l'Amundi World Investment Forum à Paris en juin 2015.

s'intéressant à ces sujets, des modèles Vectoriels AutoRégressifs (VAR) et Vectoriels à Correction d'Erreur (VEC). De plus, les Fonctions de Réponse Impulsionnelle (FRI) nous renseignent sur comment un choc sur la liquidité mondiale peut affecter les prix des actifs. Notre premier chapitre s'insère pleinement dans ce courant de littérature et y contribue à double titre.

La principale contribution du premier chapitre réside dans l'analyse des impacts potentiels de la hausse de l'excès de liquidité mondiale sur différentes classes d'actifs, telles que les marchés d'actions, les taux d'intérêt souverains à long terme et les *spreads* par rapport aux États-Unis, les taux de change, et ce, au sein des BRICS. Nous analysons aussi les impacts potentiels de l'excès de liquidité mondiale sur certaines matières premières comme l'or ou le pétrole, matières premières sur lesquelles les BRICS peuvent avoir une influence en termes d'offre et/ou de demande et, par voie de conséquence, sur les prix de ces dernières. En nous appuyant sur des modèles VAR et VEC ainsi que sur les FRI qui leur sont associées, nous estimons les interactions entre l'excès de liquidité mondiale, l'activité économique et les prix des actifs des BRICS. Malgré des résultats mitigés pour les prix des matières premières, nous montrons que l'excès de liquidité mondiale a entraîné une augmentation significative des prix des actions, une appréciation réelle des devises des BRICS, une diminution des taux d'intérêt souverains à long terme, résultant en une compression des *spreads* par rapport aux États-Unis. Il convient de noter que ce sont les marchés d'actions des BRICS qui se trouvent être les plus affectés par l'excès de liquidité mondiale. La seconde contribution du premier chapitre consiste en la construction de trois différents agrégats d'excès de liquidité mondiale afin de mieux rendre compte des tendances contemporaines de celui-ci. Pour ce faire, nous nous basons sur trois variables macroéconomiques, *i.e.*, la masse monétaire M2, le crédit domestique et les réserves de change.

Dans un deuxième temps, nous cherchons à mieux comprendre le sentiment des investisseurs[14] internationaux à l'égard des ME en tentant de mieux appréhender les investissements de portefeuille bruts vers les ME. A ce titre, les données de BdP du FMI sont les données les plus communément utilisées mais elles présentent deux inconvénients majeurs, que ce soit pour les décideurs politiques ou pour l'industrie de

[14]La notion de sentiment des investisseurs (ou sentiment de marché) peut être définie comme l'attitude générale ou l'appétit des investisseurs (ou du marché) envers un actif particulier ou plus largement envers une classe d'actifs particulière, à un instant donné. Le sentiment des investisseurs est communément reflété par la dynamique des flux et/ou des prix de cet actif ou de cette classe d'actifs. Brown et Cliff (2004) définissent le sentiment des investisseurs comme l'excès d'optimisme ou de pessimisme sur un marché particulier alors que pour Baker et Wurgler (2006), le sentiment des investisseurs exprime une certaine forme de propension à spéculer.

la gestion d'actifs. En effet, les données de BdP sont disponibles à basse fréquence, trimestrielle au mieux, et sont publiées avec un retard pouvant aller jusqu'à neuf mois. A l'instar de Calvo *et al.* (2004 et 2008) et Reinhart et Reinhart (2009) qui ont proposé des *proxies* des investissements nets de portefeuille, nous tentons donc de contourner ces inconvénients en proposant un indicateur simple et coïncidant des investissements de portefeuille bruts tels qu'ils sont disponibles à travers la BdP. Pour ce faire, nous étendons et simplifions le cadre de recherche de Miao et Pant (2012) qui, grâce aux données d'investissement de portefeuille disponibles *via* la base de données *Emerging Portfolio Fund Research* (EPFR) *Global* , proposent un indicateur composite et coïncidant des investissements de portefeuille bruts de la BdP. Entre autre chose, EPFR fournit des données hebdomadaires et mensuelles sur les investissements de portefeuille, notamment sur les marchés obligataires et d'actions, tant développés qu'émergents. Jotikasthira *et al.* (2012) ont montré qu'il existe une corrélation étroite entre les données EPFR et les investissements de portefeuille provenant de la BdP. Par la suite, Miao et Pant (2012) utilisent les données EPFR et quelques variables de contrôle afin d'estimer les investissements de portefeuilles bruts de la BdP pour les grands agrégats régionaux émergents. En outre, quelques-unes des plus grandes institutions économiques et financières internationales ont recours, depuis de nombreuses années, aux données EPFR, *e.g.*, Banque Mondiale, FMI et OCDE (2015), BRI (Miyajima et Shim, 2014) et certaines grandes banques centrales (*e.g.*, pour la BCE, *cf.* Fratzscher, 2012 et Fratzscher *et al.*, 2012), dans le but de disposer de données plus fréquentes et plus rapidement disponibles que celles de la BdP. Notre deuxième chapitre étend et simplifie le cadre de recherche proposé par Miao et Pant (2012).

La principale contribution du deuxième chapitre réside dans la construction d'un indicateur simple et coïncidant des investissements de portefeuille bruts de la BdP vers les ME. Afin de contourner les inconvénients liés à la basse fréquence et au retard de publication des données de la BdP, nous utilisons les données mensuelles d'EPFR qui, même si elles ne représentent qu'un sous-échantillon des investissements de portefeuille totaux, s'avèrent être très utiles dans l'approximation des données de la BdP. En effet, à travers un modèle à correction d'erreur, nous mettons en avant le caractère coïncidant de ces données avec celles de la BdP et plus particulièrement pour les grands agrégats régionaux et les grands ME. Cet indicateur simple et coïncidant, basé sur les données EPFR, est un *proxy* pratique pour les décideurs politiques et pour l'industrie de la gestion d'actifs qui ont besoin, tous deux, de données plus fréquentes et disponibles plus rapidement dans les prises de décisions qui leur sont propres. Après nous être assurés

que les données hebdomadaires et mensuelles fournies par EPFR sont comparables, la seconde contribution du deuxième chapitre vise à mieux appréhender le sentiment à court terme des investisseurs internationaux à l'égard des marchés d'actions et obligataires émergents. À ce titre, la construction d'indices de sentiment des investisseurs vers les ME basés sur les données EPFR nous permet de disposer d'informations pertinentes quant aux rendements de certains actifs, pris de manière agrégée.

Dans un troisième et dernier temps, nous proposons de détecter et de dater des périodes d'exubérance sur les marchés d'actions émergents, souvent appelées bulles, dans l'environnement actuel de « Nouvelle Normale ». Nous posons également la question de savoir si l'éclatement de la bulle sur les marchés d'actions chinois à l'été 2015 est le fruit d'effets de réallocation des portefeuilles ou si elle revêt simplement un caractère plus domestique. La majorité des études visant à détecter des comportements de bulles sur les marchés d'actions ou immobiliers ont utilisé des modèles fondés sur la valeur actualisée des flux de trésorerie futurs et se sont concentrés sur des tests statistiques et économétriques souvent sensibles aux spécifications du modèle, *e.g.*, Shiller (1981), Porter (1981), Blanchard et Watson (1982), West (1987), Campbell et Shiller (1987), Diba et Grossman (1988), Hamilton (1989), Kim *et al.* (2002), Homm et Breitung (2010). Plus récemment, Phillips *et al.* (2011) et Phillips et Yu (2011) proposent un test ADF récursif sur des sous-échantillons de plus en plus larges, *i.e.*, le test Sup ADF (SADF). Cependant, bien que ce test offre la possibilité de détecter une période de bulle et d'en surveiller l'évolution en temps réel, il ne permet pas de détecter de multiples bulles sur une même série temporelle. Pour contourner ce problème, Phillips *et al.* (2013a et 2013b) proposent une version généralisée du test SADF (GSADF) qui permet d'étendre de manière plus souple les sous-échantillons sur lesquels les tests ADF sont appliqués de manière récursive. Lors de la formulation du test GSADF, les chercheurs ont également proposé une nouvelle approche permettant de dater précisément les bulles, *i.e.*, la séquence *Backward* SADF (BSADF), séquence que nous utilisons afin de dater précisément des périodes d'exubérance sur les marchés d'actions émergents. Notre troisième et dernier chapitre s'inscrit dans cette littérature récente et y contribue de manière empirique.

La principale contribution du troisième chapitre vise à analyser le lien entre la recherche de rendement initiée par les investisseurs internationaux et les excès potentiels de valorisation sur les marchés d'actions émergents. Grâce à une procédure de datation précise des périodes d'exubérance sur les marchés d'actions, *i.e.*, la séquence BSADF,

nous avançons l'idée selon laquelle la recherche de rendement dans un contexte de « Nouvelle Normale », n'a pas eu pour conséquence une augmentation de la fréquence d'apparition des bulles sur les marchés d'actions émergents mais davantage à des effets de réallocation des portefeuilles ayant mené à des excès de valorisation importants sur ces mêmes marchés. La seconde contribution du troisième chapitre est de fournir une étude détaillée de la bulle qui a éclaté sur les marchés d'actions chinois à l'été 2015, bulle par ailleurs détectée par la méthodologie mise en place dans ce chapitre. En effet, d'après la procédure de datation des bulles, la période de bulle sur les marchés d'actions chinois a commencé en décembre 2014, s'est intensifiée en avril et mai 2015, a éclaté en juin 2015 et a trouvé son dénouement en juillet 2015.

Plan de thèse

Cette thèse tente d'analyser qualitativement et quantitativement les impacts, parfois déstabilisateurs, de l'excès de liquidité mondiale sur les prix des actifs des ME. Cet excès de liquidité mondiale s'est notamment matérialisé par un essor des investissements de portefeuille vers les ME, essor dont l'étude est devenue un thème central que ce soit pour les décideurs politiques ou pour l'industrie de la gestion d'actifs. La dynamique de recherche de rendement induite par la mise en place de politiques monétaires non conventionnelles par les principales banques centrales des MD a eu pour effet une forte inflation des prix des actifs, au premier rang desquels figurent les marchés d'actions émergents, marchés sur lesquels de potentielles bulles ont pu faire leur apparition dans l'ère post-Lehman.

Le premier chapitre vise à mieux appréhender la notion d'excès de liquidité mondiale ainsi que ses impacts potentiels sur les prix des actifs des ME, *i.e.*, obligations, actions, taux de change et matières premières. Ce premier chapitre se concentre sur les ME les plus emblématiques de l'ère post-Lehman : les BRICS. Dans un contexte de recherche de rendement accrue de la part des investisseurs internationaux et à l'instar du FMI, le deuxième chapitre propose un indicateur simple et coïncidant des investissements de portefeuille de la BdP vers les ME. Cet indicateur, basé sur les données fournies par EPFR, nous permet de mieux comprendre en temps réel le sentiment des investisseurs internationaux à l'égard des ME. Enfin, en accord avec les résultats du premier chapitre, le troisième chapitre cherche à identifier et à dater précisément les périodes

d'exubérance, souvent appelées bulles, sur les marchés d'actions émergents, et ce, dans un environnement de taux d'intérêt réels historiquement bas, qualifié de « Nouvelle Normale ». Cependant, nous avançons l'idée selon laquelle les excès de valorisation visibles sur ces mêmes marchés ne sont probablement que la traduction d'effets de réallocation des portefeuilles de la part des investisseurs internationaux en quête de rendement. De plus, ces effets de réallocation des portefeuilles pourraient perdurer et être à l'origine de valorisations d'équilibre des marchés d'actions émergents plus élevées qu'auparavant.

Chapitre 1 Global Excess Liquidity and Asset Prices in Emerging Markets: Evidence from the BRICS

Résumé non technique

Dans le **premier chapitre**, nous partons du constat que, depuis le début des années 2000 et l'éclatement de la bulle internet, la liquidité mondiale, au sens monétaire du terme (BRI, CGFS, 2011), a connu une très forte croissance. Dans un premier temps, les ME ont accumulé d'importantes réserves de change et, dans un second temps, les MD ont considérablement assoupli leurs politiques monétaires. Cet excès de liquidité mondiale a entrainé une augmentation de la taille des flux de capitaux internationaux, notamment en direction des ME (Fratzscher *et al.*, 2012) et, a pu avoir une incidence importante sur leur stabilité financière (Sidaoui *et al.*, 2011). Dans ce premier chapitre, nous tentons de mieux appréhender l'excès de liquidité mondiale à travers différentes mesures, *i.e.*, masse monétaire, crédit domestique et réserves de change (Baks et Kramer, 1999 ; Gouteron et Szpiro, 2005 ; De Nicolo et Wiegand, 2007 ; Sousa et Zaghini, 2007 ; Darius et Radde, 2010 ; Alessi et Detken, 2011). Nous examinons ensuite son impact sur les prix des actifs des ME (Rüffer et Stracca, 2006 ; Hartelius *et al.*, 2008 ; Brana *et al.*, 2012) et, plus précisément, des BRICS. Nous nous appuyons sur des modèles vectoriels autorégressifs et à correction d'erreur pour estimer les interactions entre l'excès de liquidité mondiale, l'activité économique et les prix des actifs des BRICS. Malgré des résultats mitigés pour les prix des matières premières, nous montrons que l'excès de liquidité mondiale a entrainé, toujours pour les BRICS, une augmentation significative des prix des actions, une appréciation réelle des devises des BRICS, une diminution des taux d'intérêt souverains à 10 ans, résultant en une compression des spreads par rapport aux États-Unis.

1.1 Introduction

Since the early 2000s and the bursting of the internet bubble, global liquidity has experienced very strong growth and has become excessive (BIS, CGFS, 2011; IMF, 2013). We distinguish two different regimes of global excess liquidity. Firstly, the saving glut in Emerging Markets (EMs) has fuelled global excess liquidity, notably via the large accumulation of foreign exchange reserves. Secondly, and in response to the global financial crisis of 2007-08 and the European sovereign debt crisis of 2010, the central banks of the main Developed Markets (DMs) have considerably eased their monetary policies by lowering interest rates and through successive rounds of quantitative easing, mainly undertaken by the Federal Reserve (Fed), the Bank of England (BoE) and the Bank of Japan (BoJ). More recently, the European Central Bank (ECB) has also decided to increase the size of its balance sheet, to stop sterilising its Securities Markets Programme and to launch its own quantitative easing. Global excess liquidity has not resulted in a resurgence of inflation on a global scale, but rather in the increase in the size of cross-border capital flows, especially towards EMs. However, these capital flow surges, linked to global excess liquidity, are reversible and may end up in sudden stops. Moreover, the risks of macroeconomic and financial imbalances in EMs have been raised by many economists including Christine Lagarde[15], the IMF's current Managing Director:

> *"Accommodative monetary policies in many advanced economies are likely to spur large and volatile capital flows to emerging economies. This could strain the capacity of these economies to absorb the potentially large flows and could lead to overheating, asset price bubbles, and the build-up of financial imbalances."*

In the monetary sense, global liquidity is defined by the Bank for International Settlements (BIS, CGFS, 2011) as the funding provided unconditionally to settle claims through the monetary authorities. Excess liquidity can be measured by different aggregates such as the money supply, domestic credit or also the foreign exchange reserves in excess of GDP. Global excess liquidity appears to play a buffer role in the DMs' deleveraging and is a catalyst for growth in EMs. In the post-Lehman era, the Zero Interest Rate Policies (ZIRP) pursued by the Fed, the BoE, the BoJ and the ECB have fuelled

[15] Annual Meeting of the International Monetary Fund (IMF) and the World Bank in Tokyo, World Economic Outlook, October 2012.

massive capital inflows, notably via some carry trade operations, mainly in Brazil and Russia. Furthermore, added to these ZIRP, the non-conventional monetary policies have exacerbated the procyclical nature of capital inflows towards EMs (Fratzscher *et al.*, 2012) and raise concerns about the emergence of bubbles in asset prices (Sidaoui *et al.*, 2011), even though the emerging financial markets are growing, *i.e.,* they are more liquid, larger and deeper. In this context, the EMs offer attractive returns for some risks which are still poorly assessed by investors.

In this chapter, we explore how best to deal with global excess liquidty and to what extent it has caused a rise in equity prices, a larger decline in EMs real interest rates than in the United States, *i.e.*, a spread compression, and a real appreciation of BRICS currencies, which is a new issue that has not yet been discussed for EMs. Most studies have focused on the DMs and on the impact of monetary expansion on GDP growth, consumer price inflation, short-term interest rates or equity prices (Baks and Kramer, 1999; Gouteron and Szpiro, 2005; Rüffer and Stracca, 2006; Giese and Tuxen, 2007; Sousa and Zaghini, 2007 and 2008; Belke *et al.*, 2010b). Some of them have broadened the scope to include more assets, *e.g.*, bond, real effective exchange rate, commodity or real estate markets (Sousa and Zaghini, 2008; Belke *et al.*, 2010a and 2013). More recent literature has transposed this issue to EMs (Rüffer and Stracca, 2006; Hartelius *et al.*, 2008; Brana *et al.*, 2012). The large majority of authors who have worked on this topic have used Vector AutoRegressive (VAR) models to analyse the links between global excess liquidity and asset prices. They also have studied the Impulse Response Functions (IRFs) to know more precisely how a shock on global liquidity could affect asset prices.

Our main contribution is to analyse the impact of the rise in global excess liquidity on different asset classes such as equities, interest rates, spreads, exchange rates and some commodities, within VAR and Vector Error Correction (VEC) frameworks. Regarding the results, according to the global excess liquidity aggregate and the models held, the IRFs analysis leads us to conclude that there is a genuine link between global excess liquidity and asset prices, notably on the BRICS real effective exchange rates. Overall, we find that global excess liquidity causes significant increases in equity and bond prices, a real appreciation of BRICS currencies, a decrease in 10-year sovereign interest rates and a spread compression. However, the results about the impact of global excess liquidity on commodity prices are more mixed. Our second contribution is to build three different global excess liquidity aggregates to better understand the contempo-

rary relationship between global excess liquidity and asset prices.

The chapter is organised as follows: As background, Section 1.2 focuses on the existing literature pertaining to global excess liquidity, its measures and its links with the asset prices. Section 1.3 introduces the economic and financial data as well the different indices of global excess liquidity we use. Section 1.4 presents our main findings, interprets them, and briefly points to some robustness checks. We conclude our study in Section 1.5.

1.2 Literature review

Here, we address both theoretical and empirical foundations of global liquidity, its excess as well as the links that may exist between global excess liquidity and asset prices.

1.2.1 Global excess liquidity and its measures

Global liquidity is a multifaceted and complex concept, which has often been suggested as an explanation for financial developments. Here, we lean on two definitions of global liquidity which are relevant both for policy makers and asset managers:

1. Monetary liquidity, which is defined as the ease of converting monetary assets into goods and services;
2. Financial market liquidity, which is defined as the ease with which large volumes of financial securities can be bought or sold without affecting the market price.

According to the BIS (CGFS, 2011), monetary liquidity refers to the concept of "official" or "public" liquidity and is defined as the funding provided unconditionally to settle claims through the monetary authorities, comprising central bank money and foreign exchange reserves. Concerning financial market liquidity, it refers to the concept of "private" liquidity, *i.e.,* created by the financial and non-financial sectors through, *inter alia*, cross-border transactions. Chatterjee and Kim (2010) argue that financial market liquidity at the micro level is related to a broader measure of liquidity at a macro level, *i.e.*, monetary liquidity. Adrian and Shin (2008) suggest that financial intermediaries raise their leverage during asset price booms and lower it during downturns, procyclical actions that tend to exaggerate the fluctuations of the financial cycle.

They argue that the growth rate of aggregate balance sheets may be the most fitting measure of liquidity in a market-based financial system. Moreover, they show a strong correlation between balance sheet growth and the easing and tightening of monetary policy. Monetary liquidity and financial market liquidity are similar notions and their own dynamics interact in a coordinated way, notably through domestic credit[16].

The academic literature on this topic allows us to identify several indicators of global liquidity. The most commonly used measures are the monetary and credit aggregates. In this line, Baks and Kramer (1999) as well as Sousa and Zaghini (2007) propose different global measures based on narrow (M1) and broad (M2 and M3) monetary aggregates for the G7 and G5 countries respectively. Gouteron and Szpiro (2005) and Alessi and Detken (2011) suggest using the domestic credit as it can be viewed as the main counterpart of monetary creation. Another stream of the literature focuses on the foreign exchange reserves to assess global liquidity. Indeed, this measure takes into account the increasing role of the liquidity created by EMs (De Nicolo and Wiegand, 2007; Darius and Radde, 2010). Beyond these quantitative indicators, price indicators can be used. Gouteron and Szpiro (2005) propose measuring global excess liquidity from the short-term real interest rate (three-month interbank rate) minus the natural interest rate[17] and also from risk premiums[18]. However, we follow Brana *et al.* (2012) in using volume-based measures to explain changes in asset prices and we do not pursue the price indicators further.

In order to define more precisely the concept of global excess liquidity, we are using the quantity theory of money[19]. This theory specifies that money supply has a direct and proportional relationship with the price level. According to this theory and the liquidity

[16] Glocker and Towbin (2013) suggest that private liquidity shocks have a substantially larger effect on key financial and macroeconomic variables, than public liquidity shocks. Moreover, they also show that global liquidity shocks are more important on a medium-term horizon, than domestic liquidity shocks.

[17] The natural interest rate may be defined as the interest rate that establishes the equilibrium between supply and demand on the goods and services market. It may notably be measured by the long-term economic growth.

[18] The thinking behind this proposal is that excess liquidity could reduce the investors' risk aversion. Thus, the spread between government and corporate bonds would constitute a measure of liquidity conditions.

[19] The quantity theory of money specifies the causal relationship between the quantity of money in circulation and the general price level. The first formulation of this theory goes back to the work of Jean Bodin in 1568 in which he studied the inflationary effects of the large influx of gold from Latin America; this influx caused a price increase across the European continent. The formalisation of this assumption is made in 1907 by Irving Fisher who, through an accounting identity, linked the money supply, its velocity, the general price level and the volume of transactions of goods and services. This theory is based on two presuppositions: (i) the change in the quantity of money induces price changes in nominal terms. In other words, the source of inflation is fundamentally derived from the growth rate of the money supply; (ii) Economic agents are supposed to be rational, *i.e.,* they know relative prices and are concerned only slightly in nominal prices. The accounting identity is written as follows: $M \cdot V = P \cdot Q$ where M is the total amount of money in circulation on average in an economy during a period, V is the velocity of money in final expenditures, P is the general price level and Q is the real output which equals real expenditures in macroeconomic equilibrium.

measures that are listed above, we can draw several normative conclusions: there is excess liquidity when the money supply or the credit supply is too high in relation to transactions by volume (goods and services or even assets). Baks and Kramer (1999) consider the average growth rate of nominal GDP as a norm for money growth. In other words, this is the level of liquidity that is consistent with the price stability. In the quantity theory of money, velocity is assumed to be relatively constant and given the real GDP growth and the money supply growth expectations, we can easily deduce the price trends. Following this hypothesis, the following relationship can be established:

$$M \cdot V = P \cdot Q \Leftrightarrow \frac{M}{P \cdot Q} = \frac{1}{V} = k \tag{1}$$

After linearisation and differentiation, we obtain:

$$\tilde{m}_t = m_t - g_t \tag{2}$$

where t denotes time, $\tilde{m}$ denotes the observed excess liquidity, m denotes the growth rate of the chosen liquidity measure and g denotes the nominal GDP growth rate.

1.2.2 The links between global excess liquidity and asset prices

By analogy with the quantity theory of money, we may reasonably assume that a surplus of money that is not spent on the market of goods and services might be spent on the financial markets. However, even if we have clarified the concept of global excess liquidity, the existence of links between rising global liquidity and rising asset prices via higher transactions remains to be demonstrated. In addition to the quantity theory of money, we need to find out more evidence on the links between monetary liquidity, funding liquidity[20] and financial market liquidity. The following theories could explain these links:

According to Keynesian theory (Keynes, 1936), money demand satisfies three motives. Transactions and precautionary motives are an increasing function of the income and speculative motive is a decreasing function of the interest rate. Speculation takes the form of a trade-off between holding money and holding long-term bonds. Incurring debt to buy securities is particularly revealing of a process feeding bullish self-fulfilling expectations on asset prices. Based on this assumption, the existence of a positive

[20] Funding liquidity is defined as the ease with which market players can obtain funding.

relationship between liquidity and asset prices might seem almost trivial. With this in mind, we can easily realise that the credit channel is a financial accelerator encouraging all the agents to indebtedness, causing a cumulative process characterised by an increase in prices and debt especially to acquire assets. In other words, we can establish that liquidity promotes the dynamics of accumulation and thus the valuation of assets.

As stated by Stiglitz and Weiss (1981), the role of money may also be studied through its counterpart of credit granting to the economy. Within this framework, a situation of abundant liquidity is equivalent to low interest rates. Given that interest rates represent the cost of capital, when interest rates are low, profitability is low and investors are willing to invest in riskier assets resulting, *de facto*, in an increase of the price of these assets. This allows us to establish that there is a negative relationship between interest rates and asset prices, and thus a positive relationship between liquidity an-Methodologicald asset prices.

According to the seminal contribution of Friedman (1988), the holding of money, which is considered as an asset among others, is related to portfolio allocation. Thus, an increase in the money supply leads to a portfolio reallocation. Therefore, if we assume that the quantity of traded securities is fixed and the money supply increases, the price of other assets, *i.e.*, equities, bonds, commodities, etc., is expected to rise in the same proportions as the price of liquidity.

Furthermore, a common factor may lead to a simultaneous trend in monetary aggregates and asset prices. This shock, whether positive or negative, is viewed as a signal, *e.g.*, better economic prospects lead to better expectations about future profits (Baks and Kramer, 1999). Thus, the link between lower interest rates and an increase in the fundamental value of asset prices follows from all the monetary policy transmission channels. Indeed, an accommodative monetary policy informs agents on the willingness of financial authorities to support growth. Investors therefore see this as a better outlook for future profits and start buying greater amounts of risky assets.

Finally, Brunnermeier and Pedersen (2009) show that, under certain conditions (mainly boom vs. bust cycles and monetary easing vs. tightening), financial market liquidity and funding liquidity are mutually reinforcing, leading to liquidity spirals. They empirically explain that market liquidity (i) can suddenly dry up, (ii) has commonality across securities, (iii) is related to volatility, (iv) is subject to "flight to quality", and

(v) co-moves with the market. Without loss of generality and given the link between the different liquidity concepts, we can extrapolate these procyclical stylised facts to monetary liquidity.

1.2.3 Previous empirical contributions

In recent years, global excess liquidity has been mostly induced by ultra-accommodative and non-conventional monetary policies conducted by the central banks of the major developed countries, *i.e.*, United States, United Kingdom, Japan and the Eurozone. These monetary policies have had, *inter alia*, the effect of lowering the cost of liquidity to international investors. This has led investors to search for yield by turning towards higher-return, and therefore riskier, assets as argued by the IMF (2010a) and Matsumoto (2011). This resulted in massive capital inflows towards EMs notably through carry trade operations, with Brazil, Russia, India, China and South Africa[21] topping the list. In addition, the post-crisis surge in capital flows has raised fears about the emergence of bubbles in asset prices (Sidaoui *et al.*, 2011), potential currency crises and the excessive growth of foreign exchange reserves, while, at the same time, the emerging financial markets are growing, *i.e.*, larger, deeper and more liquid. Indeed, the ZIRP pursued by the Fed, the BoE, the BoJ and the ECB in the post-Lehman era coupled with non-conventional monetary policies at the zero lower bound, *i.e.*, quantitative easing, credit easing and signalling, have exacerbated the procyclical nature of capital inflows towards EMs (Fratzscher *et al.*, 2012).

We may wonder to what extent the abundance of global liquidity is responsible for upward pressures on asset prices, especially in EMs. Few studies have directly investigated this issue. Most studies focused on DMs and about the impact of money growth on GDP trends, inflation, interest rate dynamics and equity prices. More recent literature transposes this problematic to EMs and broadens the spectrum of the relevant assets, *i.e.*, bonds, real effective exchange rates and commodities. The vast majority of researchers who have worked on this topic have used VAR models and have analysed IRFs.

Baks and Kramer (1999) study this issue for the G7 countries and conclude that global excess liquidity has a negative impact on real interest rates and a positive impact on equity prices. They also find some evidence for spillover effects from the volatility of

[21] These five EMs are better known by the acronym BRICS.

money growth to the volatility of equity prices across countries. By contrast, Gouteron and Szpiro (2005) find that there is no common trend in asset prices, which is not supportive of a global effect of excess liquidity. Rüffer and Stracca (2006) also examine the cross-border transmission channels of global excess liquidity in fifteen DMs and EMs and find an expansionary effect in the Eurozone and in Japan, though not in the United States. Furthermore, they highlight that global excess liquidity is a useful indicator of inflationary pressure at a global level. Giese and Tuxen (2007) show that the global excess liquidity has a positive impact on real estate prices but not on equity prices for six major DMs. Sousa and Zaghini (2007 and 2008) identify that a shock on global liquidity in the G5 countries has a positive impact on real GDP only in the short term and a positive lagged impact on aggregate prices. They also find a temporary appreciation of the real effective exchange rate of the euro. Hartelius *et al.* (2008) highlight a recent issue facing emerging bond markets: the spread compression with the United States. They conclude that the convergence of bond yields in EMs as a whole to those of the United States is largely due to improvement in fundamentals in EMs. However, they show that global excess liquidity plays an important role in spread compression. Belke *et al.* (2010a) study eleven major OECD countries and find that monetary aggregates may convey useful leading indicator information on real estate prices, gold prices, commodity prices and the GDP deflator at the global level. In contrast, they emphasise that equity prices do not show any positive response to a liquidity shock. Brana *et al.* (2012) find support that global excess liquidity generates significant spillover effects for sixteen major EMs taken as a whole. Global excess liquidity contributes to the increase in GDP and in consumer prices in these EMs. However, they conclude that the relationship between global liquidity shocks and equity prices or real estate prices is weaker. Belke *et al.* (2013) find that a positive long-term relationship exists between global liquidity and the trends in food and commodity prices. Finally, Ratti and Vespignani (2013a, 2013b, 2013c and 2015) show that there is a genuine link between global liquidity and the rise in commodity prices, especially in oil prices.

1.3 Data

In this study, we gather data for eight countries and one monetary union, representing nearly 70% of world GDP in Purchasing Power Parity (PPP) in 2014. This set of countries is composed of the G4 countries, *i.e.*, the United States, the United Kingdom, the Eurozone and Japan, and the well-known BRICS countries, *i.e.*, Brazil, Russia, India, China and South Africa. The data are collected for each country or

monetary union on a quarterly frequency over a sample period from Q1 1998 to Q1 2014, or 65 quarters (*cf.* Data Appendix for more details).

1.3.1 Economic and financial data

We use economic and financial data from different sources across variables and countries; they include the IMF, the World Bank, the OECD, the Bank for International Settlements, Eurostat, Oxford Economics through Datastream databases. More formally, the data we use are:

1. Fundamental economic data: nominal GDP in local currencies and in USD, PPP GDP[22] and consumer price indices;
2. Monetary and financial data: exchange rates against the USD, broad based real and nominal effective exchange rates[23], M2 monetary aggregates, domestic credit aggregates and foreign exchange reserves;
3. Market data: MSCI in local currency[24], EMBI Global[25] and 10-year sovereign interest rates;
4. Different indices and prices of the main commodities: GSCI[26], CRB[27], LMEX[28], gold[29] and Brent crude oil[30].

[22]Depending on the paper, the weights used to build the aggregates of global excess liquidity are done either with nominal GDP or with PPP GDP. In this study, we use nominal GDP weights to not underweight EMs in the aggregates but using PPP GDP weights leads to similar results.

[23]Real and nominal effective exchange rates indices (REER and NEER hereafter) are provided by the Bank for International Settlements and cover 61 economies including individual Eurozone countries and, separately, the Eurozone as an entity. REER and NEER are calculated as geometric weighted averages of bilateral exchange rates, adjusted by relative consumer prices in the case of REER. The weighting pattern is time-varying, and the most recent weights are based on trade from 2008 to 2010.

[24]The Morgan Stanley Capital International are the indices most regularly followed by market participants. They measure the performance of equity markets in countries or the aggregate of countries to which they refer. We also retain the MSCI BRIC in local currency. This index is a free float-adjusted market capitalisation weighted index that is designed to measure the equity market performance of the following four EM country indexes as a whole: Brazil, Russia, India and China.

[25]The Emerging Markets Bond Index Global are indices of JPMorgan Chase which track the total returns of debt securities traded abroad in EMs. The EMBI Global indices are an expanded version of the EMBI+ indices.

[26]The Goldman Sachs Commodity Index is an index originally developed by Goldman Sachs and which the ownership has been transferred to Standard & Poor's. It serves as a benchmark for investment in the commodity markets and comprises 24 commodities from all commodity sectors.

[27]The Commodity Research Bureau is an index of listed commodities on New York Mercantile Exchange, London Metal Exchange and Chicago Mercantile Exchange. It comprises 24 commodities from all commodity sectors.

[28]The London Metal Exchange Index is the benchmark for the listing of six main nonferrous metals, *i.e.*, copper, tin, lead, zinc, aluminum and nickel. In recent years, the LME has become a speculative market. Indeed, the share of commodities actually delivered after establishing a contract on the LME fell below 1%.

[29]Gold spot price in USD per ounce.

[30]We chose Brent crude oil rather than West Texas Intermediate crude oil because Brent crude oil serves as a major benchmark price for purchases of crude oil worldwide. It is used to price two thirds of the world's internationally traded crude oil supplies. However, both kinds of crude oil are traded in a narrow range.

Some data are seasonally adjusted using the X-12-ARIMA procedure[31] if necessary. Furthermore, we use *ex post* revised data for most of the economic, monetary and financial variables. Each variable, other than interest rates, were log-transformed. This especially allows a return to variables integrated of order one (*cf.* Section 4.2 for more details) and results to be analysed more easily: the estimated coefficient can be interpreted as elasticities.

The mechanism we seek to highlight in this study may be interpreted differently depending on whether we consider the nominal or real terms approach. From a theoretical point of view, the valuation of assets is related to their nominal incomes, which in turn depend on the level of prices of produced goods and services. This is the reason why we make this study on real data. To do this, we multiply the variables of interest by the GDP deflator of the country or monetary union and over the period being considered[32]. However, working with nominal data amplifies the highlights that emerge from this study.

1.3.2 The different global excess liquidity indices

In order to account for global excess liquidity, we proceed in two steps. The first step is to hold different measures of nationwide monetary liquidity. In a second step, we aggregate these indices to establish a snapshot of global excess liquidity. We hold three indices of excess liquidity on criteria such as economic relevance, data availability and homogeneity: (i) M2 monetary aggregate, (ii) domestic credit and (iii) foreign exchange reserves. Each of these measures is expressed as a share of GDP in local currencies for the first two indicators and in USD for the third one. Moreover, each of these aggregate measures were log-transformed to take into account the liquidity in excess of GDP. The aggregation of national series at a global level raises some issues from an economic standpoint. Indeed, such aggregate measures cannot be used for monetary and fiscal policy decisions at a global level[33]. However, the purpose of this study is to better understand how monetary liquidity behaves and interacts globally. There are different methods of aggregation but the non-stationarity of these time series and structural

[31] The procedure is performed on *ex post* revised data. Nevertheless, some variables are already seasonally adjusted. Market data do not need to be seasonally adjusted.

[32] In order to get real interest rates, nominal interest rates have been deflated by the annual average of domestic inflation.

[33] However, in an environment of global excess liquidity, and thus surges in capital flows, it is important for EMs to ensure financial and economic stability through improved financial regulation and other policy measures. Azis and Shin (2014) explore the range of policy options that may be deployed to address the impact of global liquidity on domestic financial and socio-economic conditions.

breaks imply that no optimal aggregation method exists (Giese and Tuxen, 2007). Nevertheless, Beyer *et al.* (2001) and more recently Anderson *et al.* (2011) discuss various criteria in order to get a useful aggregate measure of the historical Eurozone data. To this end, Beyer *et al.* (2001) propose the following three criteria:

1. A unique price series should be obtained in the sense that the aggregate of the individual price deflators coincides with the price deflator of the aggregates;
2. When a variable increases or decreases in each country, then the aggregate measure should not move in the opposite direction;
3. Aggregation should work correctly when different local currencies are used and, *a fortiori*, when a common currency is used.

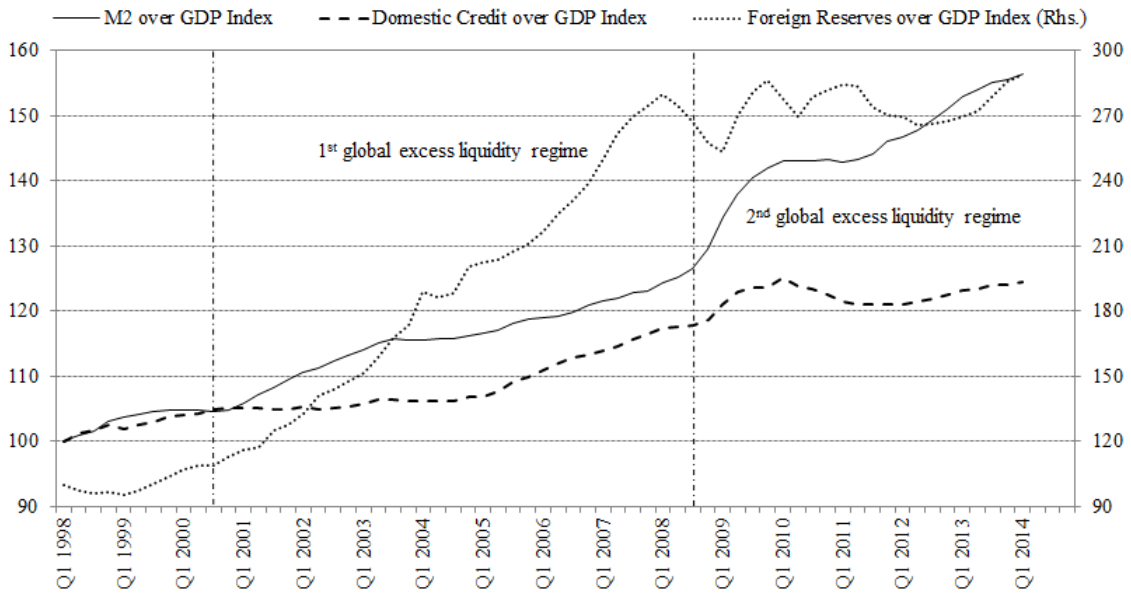
The method suggested by Beyer *et al.* (2001) uses variable weights to aggregate growth rates and proceeds in the following four steps (*cf.* Methodological Appendix for more details):

1. Calculate weights based on the relative share of the country or monetary union as regards the variable at each date, in a common currency, *e.g.*, in USD in this study;
2. Calculate within country or monetary union growth rates of each variable at each date, in local currency;
3. Aggregate growth rates of the second step using weights of the first step;
4. Cumulate aggregate growth rates to obtain aggregate levels. We use the Q1 1998 as the base to anchor the aggregate measures over time.

Figure 1 informs us on the global liquidity trend since Q1 1998 through three different indices, namely the M2 over GDP index, the domestic credit over GDP index and the foreign exchange reserves over GDP index. It shows two distinct regimes of global excess liquidity. Firstly, and after the financial crisis that followed the Internet bubble bursting, the saving glut in EMs has fuelled global excess liquidity, notably via the large accumulation of foreign exchange reserves. Secondly, and in response to the global financial crisis of 2007-08 and the European sovereign debt crisis of 2010, the central

Figure 1: Trends in the different global excess liquidity indices

Note: The figure plots the M2 over GDP index (continuous line), the domestic credit over GDP index (dashed line) and the foreign exchange reserves over GDP index (dotted line). We distinguish two different regimes of global excess liquidity. Firstly, and after the financial crisis that followed the Internet bubble bursting, the saving glut in EMs has fuelled global excess liquidity, notably via the large accumulation of foreign exchange reserves. Secondly, and in response to the global financial crisis of 2007-08 and the European sovereign debt crisis of 2010, the central banks of the main DMs have considerably eased their monetary policies by lowering interest rates and through non-conventional tools, mainly undertaken by the Fed, the BoE, the BoJ and more recently by the ECB. These highly accommodative monetary policies have led to a drastic increase in the monetary base M0 and consequently in the monetary aggregates like M2 since the end of 2008 and the announcement by the Fed of its first round of quantitative easing. Moreover, the period of credit crunch that started in 2001 seemed to find an ending at the dawn of the first announcements of quantitative easing. Unfortunately, the announcement effect only lasted a short time and domestic credit contracted once again even though the M2 monetary aggregate continued to increase. For more details on the trends in the different global excess liquidity indices by regional aggregates, *cf.* Appendix 1.1.



banks of the main DMs have considerably eased their monetary policies by lowering interest rates and through non-conventional tools, mainly undertaken by the Fed, the BoE, the BoJ and more recently by the ECB. These highly accommodative monetary policies have led to a drastic increase in the monetary base M0 and consequently in the monetary aggregates like M2 since the end of 2008 and the announcement by the Fed of its first round of quantitative easing. Moreover, the period of credit crunch that started in 2001 seemed to find an ending at the dawn of the first announcement of quantitative easing. Unfortunately, the announcement effect only lasted a short time and domestic credit contracted once again even though the M2 monetary aggregate continued to increase. For more details on the trends in the different global excess liquidity indices by regional aggregates, *cf.* Appendix 1.1.

1.4 Impact of global excess liquidity on BRICS' asset prices

In this context, it seems interesting to investigate the potential impacts of global excess liquidity on EM asset prices, and more particularly in the BRICS countries, as well as on commodities which are mostly exported by these same EMs. After describing the economic and financial environment in which this study is conducted, we develop the framework of the model and look into the main results.

1.4.1 Economic and financial analysis

From an economic standpoint, the BRICS countries alone represent more than 28% of world GDP in PPP in 2014 for more than 3 billion people, almost half of the Earth's population. According to the IMF, this group of EMs will account for nearly a third of world GDP in PPP in 2020. These five EMs, *i.e.*, Brazil, Russia, India, China and South Africa are respectively the seventh, sixth, third, second and twenty-fifth largest economies in the world[34]. During the 2000s, the BRICS countries became an economic and political reality. Indeed, in the early 2000s, O'Neill, then an economist at Goldman Sachs, proposed regrouping Brazil, Russia, India, and China under the acronym "BRIC". He noted the speed of development and financial appeal of these growing economies. Afterwards, leaders of those four EMs decided to meet at the first annual BRIC summit in 2009. This first summit marked a certain degree of institutionalisation, thereby helping to form a "new geopolitical reality". In 2011, at the third BRIC summit which took

[34] This ranking stems from the IMF list of countries by GDP in PPP in 2014. For more descriptive statistics on BRICS countries, *cf.* Appendix 1.2.

place in China, the acronym became "BRICS" with the official membership of South Africa. Moreover, the economic and financial data for BRICS countries are homogeneous and available over a longer period of time than for other EMs. However, in the 2010s, the concept of BRICS has a bit shattered and EMs now respond to more specific logic (commodity cycle, fall in oil prices, Chinese slowdown, DMs monetary policies divergence). Table 1 provides information about the average weights of each country or monetary union over the whole sample period as a percentage of GDP in PPP in each of the three aggregates considered. In the light of this table, we can say that China and India are in the BRICS countries aggregate what the United States and Eurozone are in the G4 countries aggregate, *i.e.*, the largest contributors to global growth. The GDP per capita of the BRICS countries is growing very rapidly, but it is expected to remain far below the standards of DMs even on a very long-term horizon. The BRICS countries are currently strengthening their economic and financial cooperation. Indeed, we can mention for example the New Development Bank, formerly referred to as the BRICS Development Bank, which is a multilateral development bank operated by the BRICS countries as an alternative to the existing United States-dominated World Bank and IMF. This New Development Bank was agreed by BRICS countries leaders at the fifth BRICS summit held in Durban, South Africa on March 2013 and was ratified at the sixth BRICS summit held in Fortaleza, Brazil on July 2014. It is in this way, *i.e.*, by creating multilateral supervisory and regulatory agencies, that the EMs and, *a fortiori*, the BRICS countries are becoming among the most attractive financial markets in the world. Brazil and Russia produce and export crude oil and natural gas in large quantities, while China and India are undergoing an accelerated industrialisation process, which requires a lot of energy. Meanwhile, South Africa extracts metals and minerals from its mines.

Although the responsibility of central banks in global excess liquidity that has fed speculative bubbles in the DMs has often been mentioned, it is not obvious that the same phenomenon occurred in EMs. Indeed, in a global economy with a structurally high savings rate, low employment rate and where the global excess liquidity has no impact on the prices of goods and services, we may wonder if there is an inflation of asset prices in EMs and if it is actually fuelled by global excess liquidity. According to Artus and Virard (2010), at the end of 2009, the root causes of the financial imbalances have not disappeared because the two liquidity making machines, *i.e.*, the very accommodative monetary policies of major central banks in DMs and the accumulation of foreign exchange reserves in EMs, continued to run at full speed. Moreover, we can

Table 1: Average weights of each country or monetary union over the entire sample period

Note: The table provides information about the average weights of each country or monetary union over the entire sample period as a percentage of GDP in PPP in each of the three aggregates considered. Standard deviations are in parentheses. In light of this table, we can say that China and India are in the BRICS countries aggregate what the United States and Eurozone are in the G4 countries aggregate, *i.e.*, the largest contributors to global growth. Moreover, if we look at how the weights have changed over time, it appears that the weight of the G4 countries have tended to decline in favour of those of the BRICS countries. Indeed, the weight of China rose from slightly more than 9% in early 1998 to nearly 24% in early 2014. During the same period, the weights of the United States and the Eurozone fell from about 34% and 26% to 28% and 19%, respectively.

Aggregate **Country/Area**	G4 countries	BRICS countries	All
United States	45.9% (0.9%)		31.5% (2.2%)
Eurozone	33.6% (0.5%)		23.2% (2.3%)
United Kingdom	6.8% (0.1%)		4.7% (0.4%)
Japan	13.7% (0.5%)		9.5% (1.1%)
Brazil		13.6% (2.6%)	4.1% (0.1%)
Russia		13.6% (1.8%)	4.1% (0.3%)
India		21.6% (0.4%)	6.7% (1.2%)
China		47.8% (5.2%)	15.2% (4.6%)
South Africa		3.4% (0.6%)	1.0% (0.0%)

say that these mechanisms are still at work in 2014 even though they are of different forms. At the present time, even though the Fed and the BoE have stopped their non-conventional monetary policy, the BoJ continues to inject a lot of liquidity and the ECB has recently launched a major quantitative easing coupled with an Asset-Backed Securities Purchase Programme and a Covered Bond Purchase Programme. Regarding EMs, the People's Bank of China joined their developed counterparts in boosting liquidity to address weakening growth and promote credit expansion. In addition and in response to the appreciation of the dollar induced by the tightening of the Fed's monetary policy, the EMs will have to resume their policy of accumulating foreign exchange reserves to protect themselves against the depreciation of their currencies. As we have seen above, we distinguish two different regimes of global excess liquidity. Firstly, and

after the financial crisis that followed the Internet bubble bursting, the saving glut in EMs has fuelled global excess liquidity, notably via the large accumulation of foreign exchange reserves. Secondly, and in response to the global financial crisis of 2007-08 and the European sovereign debt crisis of 2010, the central banks of the main DMs have considerably eased their monetary policies by lowering interest rates and through non-conventional tools, mainly undertaken by the Fed, the BoE, the BoJ and more recently by the ECB.

The first regime of global excess liquidity is typical of a global economy where distortions in terms of liquidity are exacerbated. Indeed, during the first regime of global excess liquidity, *i.e.*, from 2001 to 2008, we see a significant accumulation of foreign exchange reserves. This increase in the foreign exchange reserves to GDP ratio mainly comes from the BRICS countries. Over this period, Russia saw its foreign exchange reserves to GDP ratio multiplied by almost four, China and India by more than three, Brazil and South Africa by around two and a half. The G4 countries increased their foreign exchange reserves sparingly, Japan at the top of the list. Japan adopted, through its central bank, a highly accommodative monetary policy in order to support its own currency.

The second regime of global excess liquidity is characterised by a jump in the global M2 to GDP ratio. This ratio has increased very rapidly in both EMs and DMs and has slowed thereafter. However, there is an apparent dichotomy between the G4 countries and the BRICS countries. Indeed, although the acceleration of the increase in M2 over GDP indices is fairly similar in the two groups of countries, the G4 countries have higher ratios than the BRICS countries. According to the World Bank, in 2013, the M2 to GDP ratios are quite disparate for the G4 countries but very high: around 90% for the United States and the Eurozone, 160% for the United Kingdom and nearly 250% for Japan. The M2 to GDP ratios for the BRICS countries are relatively lower: 56% for Russia, between 70% and 80% for South Africa, India and Brazil and nearly 200% for China. With regard to China, this very high M2 to GDP ratio reflects the excessive monetisation of the financial system and the indebtedness promoted by the Chinese authorities (Aglietta and Maarek, 2007), notably to control their currency (PBoC and IMF, 2015).

1.4.2 Model specification

In order to study the dynamic contemporary relationships between our aggregates of global excess liquidity and the BRICS' asset prices[35], we follow the standard practices of time series analysis assuming that the properties of linear regressions are biased for non-stationary variables. We therefore start by testing the stationarity of our three aggregates of global excess liquidity, the real GDP of each of the five EMs, the different asset prices, yields, spreads and exchange rates of each of these same five EMs and some commodity prices with Augmented Dickey-Fuller (1981, ADF hereafter) and Phillips-Perron (1987 and 1988, PP hereafter) unit root tests[36]. The unit root tests results show us that in more than 85% of cases, the series are integrated of the same order, namely the order one, *i.e.*, $I(1)$. In addition, all of our global excess liquidity aggregates and real GDP of each of the five EMs are $I(1)$. Regarding the long-term interest rates, Campbell and Shiller (1987, 1988b and 1991) showed that, when long-term interest rates are $I(1)$, the expectations theory implies the existence of a cointegration relationship, the slope of the yield curve being $I(0)$. Only a handful of EMs' interest rates and spreads are stationary in level, *i.e.*, $I(0)$ (*cf.* the discussion on the monetary policy dilemma vs. trilemma as in Rey (2015) and discussed in Obstfeld (2015)). Then, we follow the standard practices in order to know if cointegration relationships exist between our $I(1)$ variables.

Then, to test whether the series are cointegrated and, if so, how many cointegrating relationships exist, we use the Johansen procedure (Johansen, 1991). After having used Akaike and Schwarz information criteria to determine the optimal number of lags that would need to be considered[37], we conclude that, in more than 60% of cases, at least one cointegration relationship exists. Then, we perform bivariate Granger non-causality tests (Granger, 1969) on the remaining 40% to find out if the different global excess liquidity aggregates Granger-cause the different asset prices. According to these tests, in almost 10% of cases, some short-term relationships exist as opposed to the long-term relationships of cointegrated models. Finally, in about 30% of cases, we do not esti-

[35] As we have seen before, each variable, other than interest rates, were log-transformed but we deliberately omit to specify that our variables are transformed for the sake of convenience.

[36] The use of several tests to conclude on the nature of stationarity of the studied variables is essential to disambiguate on some test results. Indeed, the PP unit root tests differ from the ADF tests mainly in how they deal with serial correlation and heteroskedasticity in the errors. In particular, where the ADF tests use a parametric autoregression to approximate the ARMA structure of the errors in the test regression, the PP tests ignore any serial correlation in the test regression.

[37] We follow Gouteron and Szpiro (2005) in fixing the maximum number of lags L to 4 (one year) in order to avoid having too many parameters to estimate. In most cases, minimising Akaike and Schwarz information criteria leads us to conclude that the optimal number of lags is one. In some cases, this optimal number goes up to two or three.

mate any model to avoid spurious regressions, either because the variables which are integrated of a different order cannot be cointegrated, or because no causal relationship exists.

In this study, we use the standard time series modelling taking into account the results of the preliminary tests explained above, *i.e.*, ADF, PP, Johansen cointegration and Granger non-causality tests. We use two different models to better capture the nature of the relationships between our time series. In the case where at least one cointegration relationship exists, we estimate a VEC model as in (3) and in the case where no cointegration relationship exists but that the global excess liquidity appears to be causal, in the Granger sense, for asset prices, we estimate a VAR model as in (4):

$$\Delta Y_{it} = c_i + \sum_{l=1}^{L} \gamma_{il} \Delta Y_{it-l} + \delta_i \left(a_i + b_i \cdot trend_i + \beta_i Y_{it-1} \right) + \varepsilon_{it} \tag{3}$$

$$\Delta Y_{it} = c_i + \sum_{l=1}^{L} \gamma_{il} \Delta Y_{it-l} + \varepsilon_{it} \tag{4}$$

where i denotes the different BRICS countries, t denotes time and l denotes the optimal number of lags with $L = \{1, 2, 3, 4\}$. Y_i denotes a vector containing the endogenous variables of the system, *i.e.*, the different assets (alternatively equity prices, bond yields, spreads, exchange rates and some commodity prices), the real GDP and the global excess liquidity (alternatively one of the three global excess liquidity aggregates). For each of the two different models, c_i denotes the constant term and ε_i the error term. In the VEC model in (3), $(a_i + b_i \cdot trend_i + \beta_i Y_{it-1})$ represents the cointegration relationship and includes a constant term and/or a linear trend only when there are statistically significant. In addition, a long-run relationship exists only if δ_i, which measures the speed of adjustment of the endogenous variables towards the equilibrium, is significantly negative.

All in all, there are 123 estimable models and the breakdown is as follows: five EMs, each with seven different assets, plus six different global assets, *i.e.*, MSCI BRIC, some commodities and some commodity indices, and three different global excess liquidity aggregates for a total of $(5 \cdot 7 + 6) \cdot 3 = 123$. Over the 123 estimable models and according to the preliminary tests results, more than 70% are indeed estimated (*cf.* Table 2 for more details). In order to validate the stationarity and stability of these models, we propose a kind of robustness check. It is well known in the literature on

Table 2: Estimated models according to the preliminary unit root, cointegration and bivariate Granger non-causality tests

Note: The table provides information about the estimated models. According to the preliminary unit root, cointegration and bivariate Granger non-causality tests, we conclude that most models include a cointegration relantionship (denoted by Coint.). In other models, the global excess liquidity Granger-cause asset prices (denoted by Causality) or not (denoted by an empty cell). Moreover, one model is unstable (denoted by Unstable).

Asset Class/Asset/Liquidity Aggregate		**Country**	Brazil	Russia	India	China	South Africa
Equity	MSCI	M2	Coint.	Coint.	Coint.		
		Dom. Credit	Coint.	Unstable			
		FX Reserves	Causality	Coint.	Coint.	Coint.	
	MSCI BRIC	M2					
		Dom. Credit					
		FX Reserves			Coint.		
Fixed Income	10Y Interest Rate	M2	Coint.	Coint.	Coint.	Coint.	Causality
		Dom. Credit	Coint.	Coint.			Coint.
		FX Reserves	Coint.	Coint.	Coint.	Coint.	Coint.
	EMBI Global Spread	M2	Coint.	Coint.	Coint.	Coint.	Causality
		Dom. Credit	Coint.	Coint.		Coint.	Coint.
		FX Reserves	Causality	Coint.	Coint.	Coint.	
Exchange Rate	Exchange Rate vs. USD	M2		Coint.	Coint.	Coint.	
		Dom. Credit	Coint.	Coint.		Coint.	
		FX Reserves	Coint.	Coint.	Coint.	Coint.	Coint.
	REER	M2	Coint.	Coint.		Coint.	Causality
		Dom. Credit	Coint.			Coint.	
		FX Reserves	Coint.	Coint.	Causality	Coint.	
Commodity	GSCI	M2			Coint.		
		Dom. Credit					
		FX Reserves			Coint.		
	Brent	M2			Coint.		
		Dom. Credit					
		FX Reserves			Coint.		

VAR and VEC models that the stationarity and stability properties depend on the roots of the lag polynomial. In particular, if all the inverted roots of the lag polynomial are strictly inside the unit circle, then the VAR process is stationary. For the VEC process, $k - r$ roots should be equal to the unity and so $k(p-1) + r$ inverted roots should be strictly inside the unit circle, where k is the number of endogenous variables, r is the number of cointegration relationships and p is the largest lag. According to this robustness check, only one VEC model is unstable and hence, this estimate is excluded from the study (*cf.* Table 2 for more details).

1.4.3 Global excess liquidity promotes the search for yield

Here, we want to highlight the positive impacts of global excess liquidity in some BRICS' assets. Depending on the countries and assets, responses to a shock on liquidity have the expected sign in more than half of cases. Finally, to better identify their sensibility to some economic and econometric changes, we propose two additional robustness checks. First, we compare the results of our estimates in real terms with estimates in nominal terms and second, we estimate our model in a panel approach.

1.4.3.1 Impulse response functions and forecast error variance decompositions

We want to see how the different BRICS' assets are impacted by the increase in global liquidity as measured by our three different indicators of global excess liquidity. To do this, we look at how the assets react to a positive one standard deviation shock on the logarithm of each liquidity aggregate. We focus on reviewing the Impulse Response Functions (IRFs). According to the common practices, we estimate the IRFs with their 90% confidence intervals. We compute these confidence intervals using Monte-Carlo simulations with 5,000 replications in the case of the VAR model and using the bootstrap method[38] in the case of the VEC model, still using Monte-Carlo simulations with 5,000 replications. The responses are computed for 12 quarters for VAR models and 16 quarters for VEC models. If confidence intervals do not contain 0, the IRF is significant. If confidence intervals contain 0, the IRF is not significant but we keep the sign of the IRF as a result.

As we can see in Table 3 (some striking examples of IRFs are available in Appendix 1.3), global excess liquidity has played an important role in the evolution of some asset prices. Overall, global excess liquidity pushed up equity prices and BRICS currencies, while it brought down the fixed income rates and has more or less tightened the interest rate spreads depending on the countries. With more granularity, several highlights appear:

1. The asset class which is the most significantly impacted by a positive one standard deviation shock on global excess liquidity is the BRICS' equity markets. Indeed, in terms All countries except South Africa have seen their MSCI indices increase

[38] Theoretically, it is possible to compute analytical confidence intervals using an asymptotic approximation, but this may lead to misleading confidence intervals because asymptotic formulas are known to give a poor approximation of the finite-sample properties.

[39] For the MSCI BRIC, we can only consider the nominal terms approach because it could be difficult and misleading to deflate an aggregated equity index.

Table 3: Summary results of the IRFs

Note: The table provides information about the results of the simulated IRFs based on the estimated VAR and VEC models. The responses are computed for 12 quarters for VAR models and 16 quarters for VECM models. For each BRICS country, we analyse the IRF of each asset price or exchange rate to a positive one standard deviation shock on the logarithm of each liquidity aggregate, except for the MSCI BRIC and commodity prices which are dealt with more globally. The symbol "--" denotes a negative and significant impact to a given asset price of a one standard deviation shock on a given liquidity aggregate; "-" denotes a negative and non-significant impact; "0" denotes no impact; "+" denotes a positive and non-significant impact; "++" denotes a positive and significant impact; an empty cell denotes that no model has been estimated according to the preliminary unit root and cointegration tests. For example, in the case of the MSCI Brazil, a one standard deviation shock on the M2 over GDP aggregate is associated with an increase in equity prices but the impact is non-significant according to the 90% confidence interval. However, a one standard deviation shock on the domestic credit over GDP aggregate or on the foreign exchange reserves over GDP aggregate (FX Reserves in the table below) is associated with a significant increase in equity prices. We can therefore conclude that the global excess liquidity has a positive impact on the price of Brazilian equities as reflected by the MSCI Brazil.

Asset Class/Asset/Liquidity Aggregate		**Country**	Brazil	Russia	India	China	South Africa
Equity	MSCI	M2	+	+	+		
		Dom. Credit	++				
		FX Reserves	++	++	++	++	
	MSCI BRIC[39]	M2					
		Dom. Credit					
		FX Reserves			++		
Fixed Income	10Y Interest Rate	M2	--	-	-	-	+
		Dom. Credit	-	-			-
		FX Reserves	-	-	-	--	--
	EMBI Global Spread	M2	--	--	0	0	--
		Dom. Credit	-	+		0	+
		FX Reserves	-	+	0	0	
Exchange Rate	Exchange Rate vs. USD	M2		-	+	+	
		Dom. Credit	++	+		+	
		FX Reserves	-	++	++	0	++
	REER	M2	-	-		-	++
		Dom. Credit	+			+	
		FX Reserves	-	++	+	-	
Commodity	GSCI	M2			--		
		Dom. Credit					
		FX Reserves			++		
	Brent	M2			--		
		Dom. Credit					
		FX Reserves			++		

with global liquidity. We obtain the same results for the MSCI BRIC in local currencies. It is the variation in the foreign exchange reserves over GDP aggregate which has the greatest significant impact on the equity prices.

2. On the fixed income side, the foreign exchange reserves over GDP aggregate and the M2 over GDP aggregate contributed to significantly lower sovereign 10-year interest rates in all the BRICS, except for India where it is not significant. According to the M2 over GDP aggregate, spread compression is significant for Brazil, Russia and South Africa.

3. Concerning the foreign exchange markets, the currencies have globally appreciated against USD and in real effective terms. Except for Brazil, it is the foreign exchange reserves over GDP aggregate which has the most significant impact on BRICS currencies. Nevertheless, the Chinese yuan is the only currency that has not been impacted by global excess liquidity.

4. Finally, as for the three different global excess liquidity aggregates, the results for the main commodity prices, *i.e.*, the GSCI and the Brent, are more mixed. They were positively impacted during the first regime of global excess liquidity, when EMs accumulated some large foreign exchange reserves from early 2001 to mid-2008, by the yardstick of the global financial crisis; whereafter the second regime of global excess liquidity takes place. In this second regime, the commodity prices started to fall since the developed central banks have injected significant liquidity until 2015.

While IRFs evaluate the effects of a shock to one endogenous variable on the other variables in VAR or VEC models, forecast error variance decomposition separates the variation in an endogenous variable into the component shocks to VAR or VEC models. Thus, the forecast error variance decomposition provides information about the relative importance of each random innovation in affecting the variables in VAR or VEC models. In order to remain consistent in our approach, we will consider only the forecast error variance decompositions for the models we discussed above.

By analysing the relevant forecast error variance decompositions (some striking examples are available in Appendix 1.4), we can draw several conclusions. First, after sixteen quarters, more than 80% of the BRICS' asset innovations are explained by their own innovations in about two thirds of cases. Second, in the remaining one third, the

BRICS' asset innovations are mainly explained by the different global excess liquidity aggregates innovations. Lastly, within the global excess liquidity aggregates, it is the foreign exchange reserves and, to a lesser extent, the M2 aggregate which explain the BRICS' asset innovations.

1.4.3.2 Robustness checks

In order to ensure the robustness of our results, we propose two robustness checks. First, we follow the same time series methodology replacing data in real terms by data in nominal terms. Second, we estimate a Panel Dynamic Ordinary Least Squares model (PDOLS hereafter) with country fixed effects. This PDOLS model, introduced by Kao and Chiang (2000) and refined by Mark and Sul (2003), involves augmenting the panel cointegrating regression equation with cross-section specific lags and leads of the explanatory variables in first difference to eliminate the asymptotic endogeneity and serial correlation.

For our first robustness check, we apply exactly the same methodology to the data in nominal terms. The conclusion is that the same aggregates of global excess liquidity lead the same assets upward or downward whether in real or nominal terms (for more detailed results, *cf.* Appendix 1.5). The main difference between these two estimates is the amplitude of the IRFs to a shock on global liquidity. Indeed, in the broader sense, global excess liquidity causes a significant increase in equity and bond prices, an appreciation of BRICS currencies, a decrease in 10-year sovereign interest rates and a spread compression both in real and nominal terms. Moreover, the IRFs in nominal terms are more significant than the IRFs in real terms. In the case of Russia and compared with the real terms approach, a one standard deviation shock on the foreign exchange reserves aggregate leads to a higher increase in the NEER. In the case of India, the IRF on the NEER to a shock on the foreign exchange reserves aggregate remains positive, as for the REER, but becomes significant. The same is true in other settings, *e.g.*, for the Brazilian and Chinese equity markets, for the Russian and Chinese 10-year sovereign interest rates, and for the Brazilian and South African spread compressions. Regarding the forecast error variance decompositions in the nominal terms approach, we get the same qualitative conclusions as for the real terms approach. In addition, after sixteen quarters, the BRICS' asset innovations are more explained by the different global excess liquidity aggregates innovations in the nominal terms approach than in the real terms approach. Overall, this first robustness check attests to the relevance of

our main results.

Our second robustness check consists in the estimation of a PDOLS model. We chose this panel model because it has several advantages. First, the panel approach, with its structure in two dimensions, provides more complete information than in the time series approach. More precisely, we can better understand our issue and provide a more global answer together with more granularity on the question of the different global excess liquidity regimes. Second, according to Kao and Chiang (2000) and Mark and Sul (2003), the PDOLS estimators appear to outperform all other panel estimators for non-stationary panel data, *e.g.*, the Panel Fully Modified OLS. In order to avoid some statistical bias in the estimates of the links between global excess liquidity and the EMs asset prices, we add a control variable that reflects the implied volatility of S&P 500 index options, *i.e.*, the VIX index, as in Da *et al.* (2014), Rey (2015) and Rey and Passari (2015). Well-known as a "fear index" for worldwide asset markets, it reflects both stock market uncertainty and a variance risk premium. The first step of the panel analysis is to investigate the statistical properties of our stacked data. Hence, we perform some panel stationarity and unit root tests and we reasonably conclude that our variables are non-stationary in level and $I(1)$ (for more detailed results, *cf.* Appendix 1.6). Then, we perform some panel cointegration tests[40] in order to verify the presence of a long-run relation between the variables in our dataset and we conclude that our series are cointegrated in more than 85% of cases[41]. However, we do not find evidence that there could be some cointegration relationships on the two sub-periods that characterise the two global excess liquidity regimes, *i.e.*, from Q3 2000 to Q2 2008 and from Q3 2008 to Q1 2014. After having highlighted the presence of cointegration relationships in the full sample period, we estimate a PDOLS model as in (5):

$$Y_t = c_i + \sum_{l=-L_1}^{L_2} \gamma_{ijl} \Delta X_{jt+l} + \delta_j X_{jt} + \varepsilon_t \tag{5}$$

where i denotes the different BRICS countries, t denotes time and l denotes the optimal number of lags and leads[42] with $L_1 = \{1, 2, 3, 4\}$ and $L_2 = \{1, 2, 3, 4\}$. Y denotes the different dependent variables, *i.e.*, the different assets (alternatively equity prices, bond yields, spreads, exchange rates and some commodity prices). X_j denotes the j different

[40] Here, we use the well-known panel cointegration tests proposed by Pedroni (1999).

[41] Because of the huge number of cointegration tests and space limitation, the panel cointegration tests results are not reported but available upon request.

[42] In most cases, minimising Akaike and Schwarz information criteria leads us to conclude that the optimal number of lags and leads is often the same. In some cases, this optimal number of lags and leads may be different.

explanatory variables, *i.e.*, the real GDP, the VIX index and the global excess liquidity (alternatively one of the three global excess liquidity aggregates). Country fixed effects are denoted by c_i and ε denotes the error term. In addition, the short-run dynamics coefficients γ_{ij} are allowed to be cross-section specific.

Table 4 presents the results of the PDOLS estimates in (5) which reflect the links between global excess liquidity and asset prices. Regarding the model with a cointegration relationship, we conclude that the global excess liquidity aggregates are significant in about 90% of cases and are in the expected direction in all these cases. On the VIX index, even though it is significant in more than half of cases, we highlight that the VIX index is rather weakly significant or not significant to explain the changes in BRICS' asset prices, *i.e.*, excluding commodity prices. The R^2 should be interpreted only within the estimates and we observe that our PDOLS models fit better for equity prices, exchange rates and commodity prices than for bond prices and spreads. Overall, this second robustness check attests to the relevance of our main results.

Table 4: Summary of PDOLS estimates of the links between global excess liquidity and asset prices

Note: The table presents the results of the PDOLS estimates in (5) which reflect the links between global excess liquidity and asset prices. Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively. According to the panel cointegration tests proposed by Pedroni (1999), our series are not cointegrated in only three cases, denoted by "No cointegration". Regarding the models with a cointegration relationship, we conclude that the global excess liquidity aggregates are significant in about 90% of cases and are in the expected direction in all these cases. On the VIX index, even though it is significant in more than half of cases, we highlight that the VIX index is rather weakly significant or not significant to explain the changes in BRICS' asset prices, *i.e.*, excluding commodity prices. The R^2 should be interpreted only within the estimates and we observe that our PDOLS models fit better for equity prices, exchange rates and commodity prices than for bond prices and spreads.

Dependent Variable: *Asset*
Q2 1998 - Q1 2014

Asset/Liquidity Aggregate \ **Variable**		Real GDP	VIX Index	Liquidity Aggregate	*Number of Observations*	*Adj. R-Squared*
MSCI	M2	0.542***	-0.364	0.474	309	0.89
		(0.210)	*(0.298)*	*(0.559)*		
	Dom. Credit	-0.319*	-0.503**	5.866***	304	0.94
		(0.171)	*(0.207)*	*(0.846)*		
	FX Reserves	-0.243	-0.343*	0.801***	302	0.95
		(0.174)	*(0.179)*	*(0.142)*		
10Y Interest Rate	M2	2.381	4.322	-22.888***	280	0.70
		(2.289)	*(2.808)*	*(5.957)*		
	Dom. Credit	4.037*	5.274**	-53.371***	280	0.73
		(2.262)	*(2.514)*	*(10.937)*		
	FX Reserves	6.363**	-0.232	-12.793***	274	0.78
		(2.749)	*(2.486)*	*(2.004)*		
EMBI Global Spread	M2			No cointegration		
	Dom. Credit			No cointegration		
	FX Reserves	0.432	1.430***	-1.090***	303	0.81
		(0.323)	*(0.341)*	*(0.264)*		
Exchange Rate vs. USD	M2	-0.361**	-0.221	0.894***	307	0.98
		(0.144)	*(0.157)*	*(0.325)*		
	Dom. Credit	-0.232*	-0.133	0.803*	297	0.98
		(0.132)	*(0.156)*	*(0.420)*		
	FX Reserves	-0.386***	0.175	0.469***	298	0.99
		(0.091)	*(0.115)*	*(0.091)*		
REER	M2	0.137	0.002	0.484*	311	0.60
		(0.109)	*(0.136)*	*(0.281)*		
	Dom. Credit			No cointegration		
	FX Reserves	0.263***	-0.038	-0.011	306	0.74
		(0.090)	*(0.102)*	*(0.081)*		
GSCI	M2	0.685***	-0.432***	0.916***	319	0.82
		(0.120)	*(0.157)*	*(0.307)*		
	Dom. Credit	0.327***	-0.739***	3.421***	319	0.86
		(0.106)	*(0.113)*	*(0.501)*		
	FX Reserves	0.295***	-0.616***	0.557***	303	0.94
		(0.083)	*(0.089)*	*(0.070)*		
Brent	M2	0.870***	-0.568***	1.614***	319	0.84
		(0.162)	*(0.213)*	*(0.416)*		
	Dom. Credit	0.461***	-1.029***	4.878***	319	0.87
		(0.148)	*(0.159)*	*(0.701)*		
	FX Reserves	0.612***	-0.770***	0.616***	299	0.93
		(0.132)	*(0.144)*	*(0.114)*		

1.5 Conclusion

Over the last fifteen years, global liquidity has become overabundant in different forms and encouraged the search for yield by investors who may have access to this excess liquidity. In this chapter, we have examined the impact of global excess liquidity on asset prices for the well-known BRICS countries. First, we built three global excess liquidity aggregates based on the foreign exchange reserves, the M2 money supply and the domestic credit. Second, we estimated the interaction between global excess liquidity, economic activity and asset prices through vector autoregressive and error correction models. We focused on a wide range of asset classes, such as equities, interest rates, spreads, exchange rates for BRICS and some commodities.

Overall, global excess liquidity pushed up equity prices and BRICS currencies, while it brought down the fixed income rates and has more or less tightened the interest rates spreads depending on the countries. Regarding exchange rates, global excess liquidity is a factor that explains the appreciation trend both against the dollar and in real effective terms. Moreover, we found that foreign exchange reserves have a genuine link with asset prices considering the overall results of this chapter. Indeed, this key measure of the first global excess liquidity regime explains the trend in asset prices in the desired direction in almost two thirds of cases. The global money supply M2 is the measure of the second global excess liquidity regime and explains the trend in asset prices in the desired direction in more than four out of ten cases, while it is only in about one third of cases for the global aggregate of domestic credit. Country by country, the Brazilian, Russian and Indian assets have been the most impacted by the global excess liquidity, whatever the regime. For China, the growth of domestic credit and M2 money supply reflects the excessive monetisation of the financial system and the indebtedness promoted by the Chinese authorities, notably to control their currency. The results for South Africa are less eloquent. Last but not least, according to our robustness checks, the results are broadly weakly sensitive to some economic and econometric changes.

Data Appendix:

Note: The table shows the Datastream mnemonics of the data which are used in this chapter. The data are gathered on a quarterly frequency from Q1 1998 to Q1 2014. * denotes that the data have been seasonally adjusted using the X-12-ARIMA procedure. Otherwise, the data are already seasonally adjusted or do not need to be seasonaly adjusted. For the Eurozone, all the Datastream mnemonics beginning with EK refer to series for which the data are consolidated for all member countries retroactively. For the only one Datastream mnemonic beginning with EM, the serie consolidates the new member countries that integrate the Eurozone.

Country / **Variable**	Brazil	Russia	India	China	South Africa	United States	United Kingdom	Eurozone	Japan
Nominal GDP (local currency)	BRXGDP..A*	RSXGDP..B*	INXGDP..A*	CHXGDP..A*	SAXGDP..B	USXGDP..B	UKXGDP..B	EKXGDP..A	JPXGDP..B
Nominal GDP (USD)	BRXGD$..A*	RSXGD$..A*	INXGD$..A*	CHXGD$..A*	SAXGD$..A*	USXGD$..A	UKXGD$..A	EKXGD$..A*	JPXGD$..A*
PPP GDP (USD)	BRXGPP..A*	RSXGPP..A*	INXGPP..A*	CHXGPP..A*	SAXGPP..A*	USXGPP..B	UKXGPP..B	EKXGPP..A*	JPXGPP..A*
CPI	BRXCPI..F*	RSXCPI..F*	INXCPI..F*	CHXCPI..F*	SAXCPI..F*	USXCPI..E	UKXCPI..F*	EKXCPI..F*	JPXCPI..F*
Exchange Rate vs. USD	BRACRU$	CISRUB$	INDRUP$	CHIYUA$	COMRAN$		USSTBOE	EUUSBOE	JPUSBOE
M2	BRXMON2.A*	RSXMON2.A*	INXMON2.B*	CHXMON2.A*	SAXMON2.A*	USXMON2.B	UKXMON2.B	EKXMON2.A*	JPXMON2.B
Domestic Credit	BRBLCBPAA*	RSBLCBPAA*	INBLCBPAA*	CHBLCBPAA*	SABLCBPAA*	USBLCBPAA*	UKBLCBPAA*	EKBLCBPAA*	JPBLCBPAA*
Foreign Exchange Reserves	BRQ.1D.DA*	RSQ.1D.DA*	INQ.1D.DA*	CHQ.1D.DA*	SAQ.1D.DA*	USQ.1D.DA*	UKQ.1D.DA*	EMQ.1D.DA*	JPQ.1D.DA*
MSCI	MSBRAZL	MSRUSSL	MSINDIL	MSCHINL	MSSARFL				
EMBI Global	JPMGBRA	JPMGBRUS	JPMGASI	JPMGCHN	JPMGSAF				
Nominal 10-year Sovereign Interest Rate	BRXRLG..R	RSXRLG..R	INXRLG..R	CHXRLG..R	SAXRLG..R				
Nominal 10-year Spreads vs. the United States						USXRLG..R			
GSCI	GSCITOT								
CRB	CRBSPOT								
LMEX	LMEINDX								
Gold	GOLDBLN								
Brent	OILBREN								

Methodological Appendix:

The method suggested by Beyer *et al.* (2001) uses variable weights to aggregate growth rates and proceeds in the following four steps:

1. Calculate weights ω_{ijt} based on the relative share of the country or monetary union i as regards the variable Y_j ($j = M2$, $Domestic\,Credit$, $Foreign\,Reserves$) at time t, in a common currency, *e.g.*, in USD in this study:

$$\omega_{ijt} = \frac{Y_{ijt}}{\sum_{i=1}^{9} Y_{ijt}} \tag{6}$$

2. Calculate within the country or monetary union growth rates X_i of each variable Z_j (where $Z_j = \frac{Y_j}{\sum_{k=t-3}^{t} GDP_{ik}}$) at time t, in local currency:

$$\Delta log\left(X_{ijt}\right) = \Delta log\left(Z_{ijt}\right) \cdot GDP\,Deflator \tag{7}$$

3. Aggregate growth rates of (7) using weights of (6):

$$\overline{X_{jt}} = \sum_{i=1}^{9} \omega_{ijt} \Delta log\left(X_{ijt}\right) \tag{8}$$

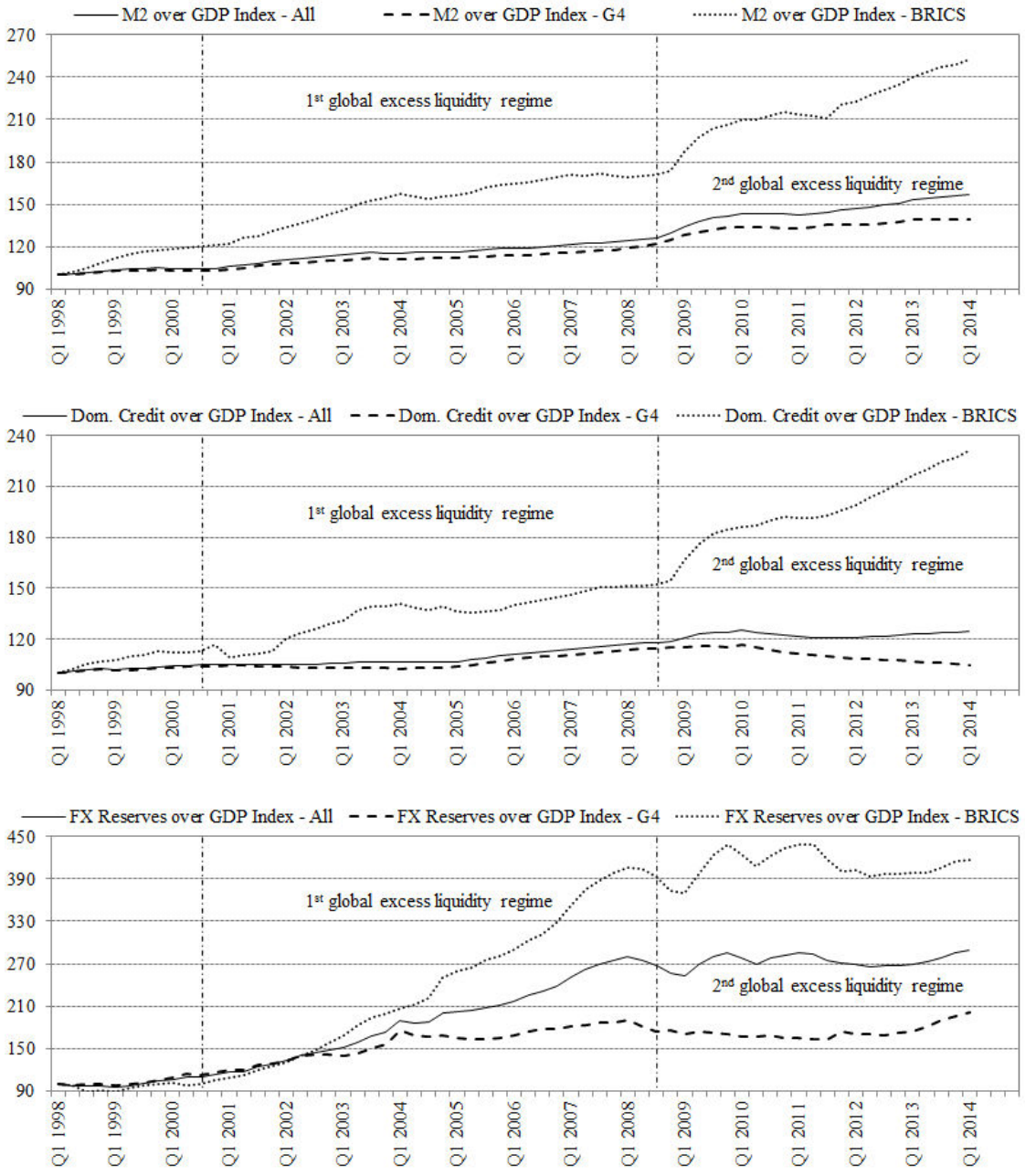
4. Cumulate aggregate growth rates to obtain aggregate levels. We use the Q1 1998 as the base to anchor the aggregate measures over time:

$$Y_{jt} = Y_{jt-1}\left(1 + \overline{X_{jt}}\right) \tag{9}$$

with $Y_{j,Q1\,1998} = X_{ij,Q1\,1998} = 100\ \forall i$ and $\forall j$.

Appendix 1.1: Trends in the different global excess liquidity indices by regional aggregates

Note: The figures plot the different global excess liquidity indices by regional aggregates, namely the All aggregate (continuous line), the G4 countries aggregate (dashed line) and the BRICS countries aggregate (dotted line). As in Figure 1, we distinguish two different regimes of global excess liquidity. The first one occurs between Q3 2000 and Q2 2008 while the second one takes place from Q3 2008 to Q1 2014.



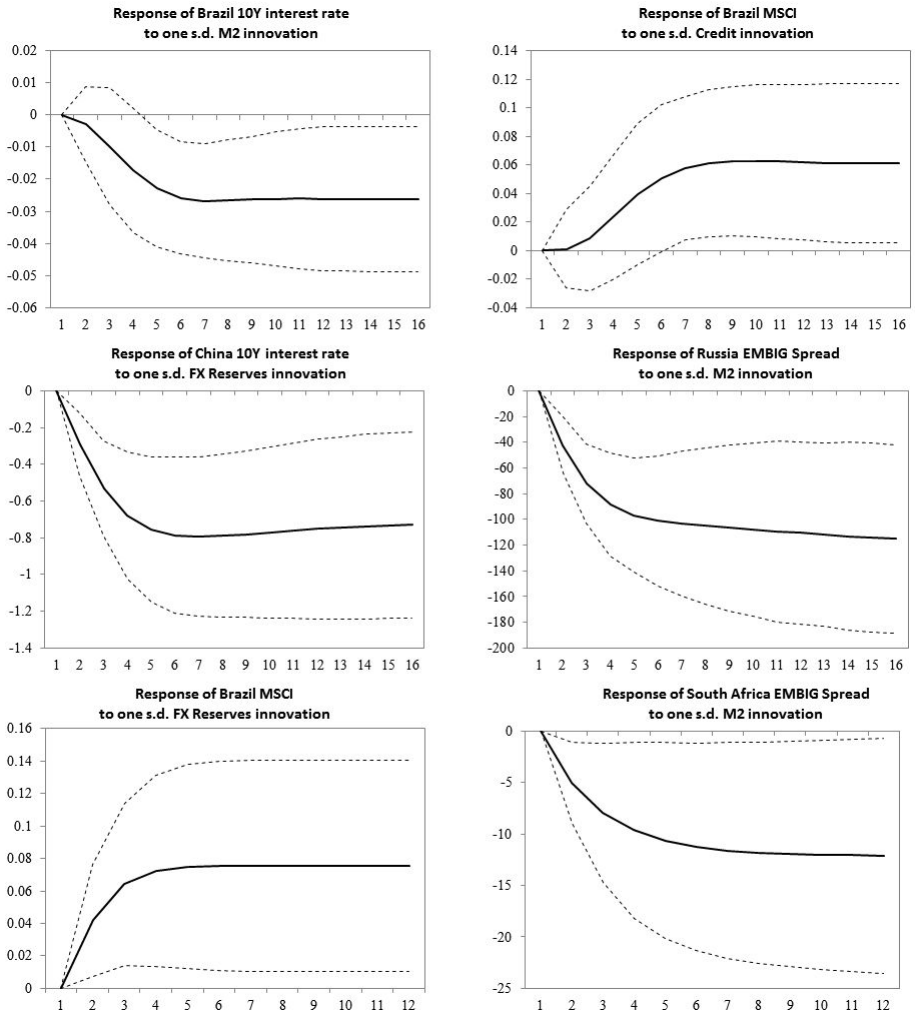
Appendix 1.2: Some descriptive statistics on BRICS countries

Note: The table provides information about the economic and financial environment in which the BRICS countries evolve. On the economic side, we focus on (i) 5-year average real GDP growth, *i.e.*, between 2010 and 2014, (ii) the 2014 PPP GDP world rank, (iii) the 2014 PPP GDP per capita, (iv) 5-year average inflation, still between 2010 and 2014, (v) the foreign exchange reserves (excluding gold reserves) at the end of 2014, (vi) the percentage of world total foreign exchange reserves (excluding gold reserves). On the financial side, we focus on the MSCI capitalisations at the end of 2014.

Country / **Variable**	Brazil	Russia	India	China	South Africa
Real GDP growth (5y. avg., in %)	3.3	2.8	6.4 (FY)	8.5	2.4
PPP GDP world rank	7	6	3	2	25
PPP GDP per capita (in USD)	16,096	24,805	5,855	12,880	13,046
Inflation (5y. avg., in %)	5.9	7.0	9.5	3.2	5.4
Foreign exchange reserves (in USD Billion)	354.8	327.7	295.9	3,843.0	41.5
Foreign exchange reserves (% of world total)	3.1	2.8	2.6	33.2	0.4
MSCI capitalisation (in USD Million)	313,935	117,065	269,231	796,285	276,607

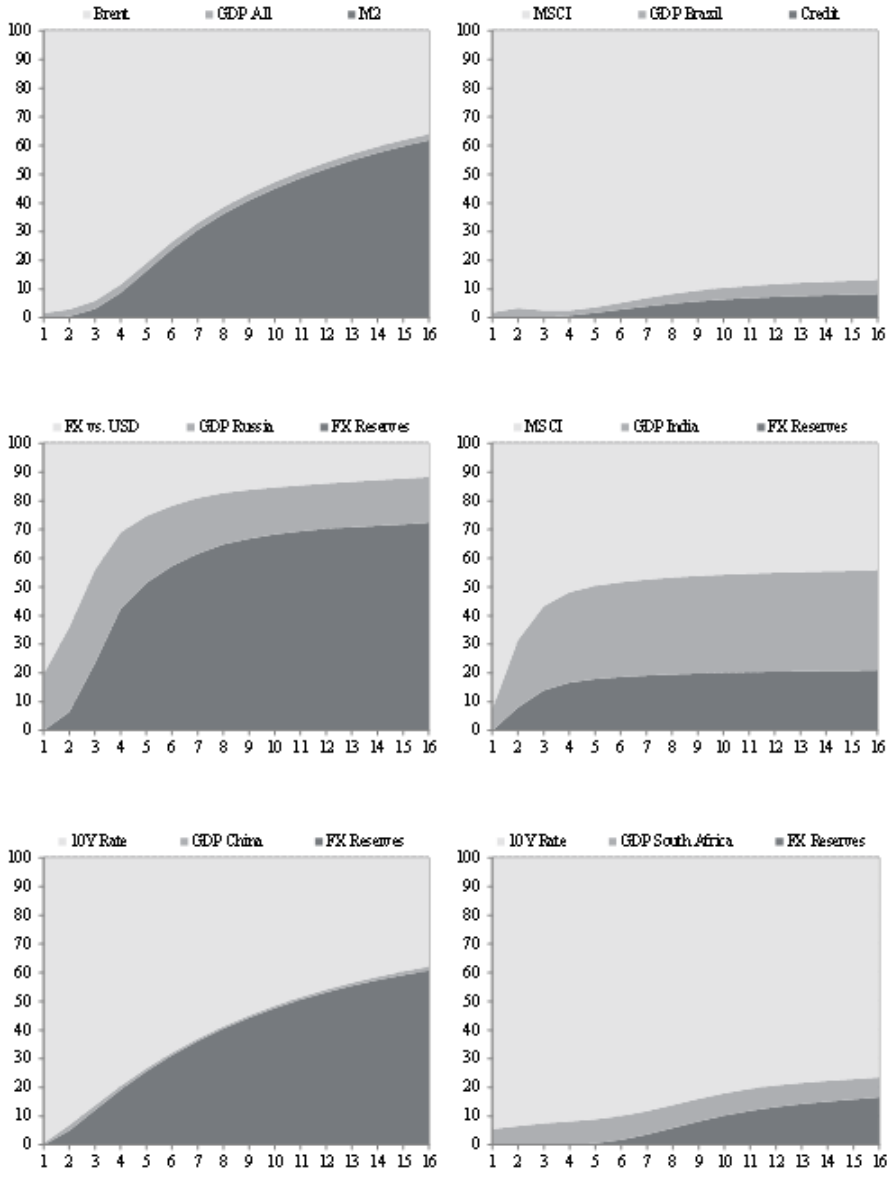
Appendix 1.3: A bunch of IRFs

Note: The figures plot the IRFs of some of the most impacted asset class by global excess liquidity. We look at how the assets react to a positive one standard deviation shock on the logarithm of each liquidity aggregate. We focus on reviewing the Impulse Response Functions (IRFs). According to the common practices, we estimate the IRFs with their 90% confidence intervals. We compute these confidence intervals using Monte-Carlo simulations with 5,000 replications in the case of the VAR model and using the bootstrap method in the case of the VEC model, still using Monte-Carlo simulations with 5,000 replications. The responses are computed for 12 quarters for VAR models and 16 quarters for VEC models. If confidence intervals do not contain 0, the IRF is significant. If confidence intervals contain 0, the IRF is not significant but we keep the sign of the IRF as a result.



Appendix 1.4: A bunch of forecast error variance decompositions

Note: The figures plot the forecast error variance decompositions of some of the most impacted asset class by global excess liquidity. Light grey represents the own innovations of the asset, grey represents the GDP innovations and dark grey represents the global excess liquidity innovations. For instance, after sixteen quarters, Brent innovations are explained by around 62% by M2 innovations, 2% by GDP innovations and 36% by its own innovations. Overall, within the global excess liquidity aggregates, it is the foreign exchange reserves and, to a lesser extent, the M2 aggregate which best explain the BRICS' asset innovations.



Appendix 1.5: Summary results of the IRFs in nominal terms

Note: The table provides information about the results of the simulated IRFs based on the estimated VAR and VEC models in nominal terms. The responses are computed for 12 quarters for VAR models and 16 quarters for VECM models. For each BRICS country, we analyse the IRF of each asset price or exchange rate to a positive one standard deviation shock on the logarithm of each liquidity aggregate, except for the MSCI BRIC and commodity prices which are dealt with more globally. The symbol "- -" denotes a negative and significant impact to a given asset price of a one standard deviation shock on a given liquidity aggregate; "-" denotes a negative and non-significant impact; "0" denotes no impact; "+" denotes a positive and non-significant impact; "++" denotes a positive and significant impact; an empty cell denotes that no model has been estimated according to the preliminary unit root and cointegration tests.

Asset Class/Asset/Liquidity Aggregate		**Country**	Brazil	Russia	India	China	South Africa
Equity	MSCI	M2	++	+	+		
		Dom. Credit	++				
		FX Reserves	++	++	++	++	+
	MSCI BRIC	M2			+		
		Dom. Credit					
		FX Reserves			++		
Fixed Income	10Y Interest Rate	M2	- -	-	-	- -	+
		Dom. Credit	-	-			-
		FX Reserves	-	- -	-	- -	- -
	EMBI Global Spread	M2	- -	- -	0	0	- -
		Dom. Credit	-				0
		FX Reserves	- -	+	0	0	-
Exchange Rate	Exchange Rate vs. USD	M2		-	+	+	
		Dom. Credit	++	+		+	-
		FX Reserves	-	++	++	0	++
	NEER	M2	-	-		-	++
		Dom. Credit	+			+	
		FX Reserves	-	++	++	-	
Commodity	GSCI	M2			- -		
		Dom. Credit					
		FX Reserves			++		
	Brent	M2			- -		
		Dom. Credit					
		FX Reserves			++		

Appendix 1.6: Panel stationarity and unit root test results

Note: The table presents the results of the most commonly used panel stationarity and unit root tests, *i.e.*, Hadri (2000), Levin, Lin and Chu (2002, LLC hereafter), Im, Pesaran and Shin (2003, IPS hereafter), Maddala and Wu (1999) for Fisher-type tests using ADF and PP tests. The figures reflect the test-statistics in level (in first difference) of the panel stationarity and unit root tests with country fixed effects. *, ** and *** denote rejecting the null hypothesis at the 10%, 5% and 1% level of confidence, respectively. In Hadri (2000), the null hypothesis is the stationarity of the variable. In LLC, the null hypothesis assumes a common unit root. In IPS, ADF Fisher and PP Fisher, the null hypothesis assumes an individual unit root. According to the Hadri (2000) stationarity tests, all the variables are $I(1)$. According to LLC, IPS, ADF Fisher and PP Fisher unit root tests, the results are more mixed for some variables, *i.e.*, the 10-year sovereign interest rates, the exchange rates against the USD and the VIX. Nonetheless and in the light of all these tests results, it is reasonable to conclude that our variables are non-stationary in level and $I(1)$.

Tests / **Variables**	Hadri	LLC	IPS	ADF Fisher	PP Fisher
MSCI	7.02***	-0.53	-0.97	15.21	16.02*
	(-0.62)	(-17.28***)	(-14.84***)	(172.30***)	(172.04***)
10Y Interest Rate	9.24***	-1.02	-2.67***	23.96***	38.62***
	(1.76*)	(-8.29***)	(-11.18***)	(123.49***)	(106.23***)
EMBI Global Spread	6.00***	-0.83	-1.63*	18.27*	12.66
	(-1.15)	(-15.95***)	(-13.09***)	(148.99***)	(129.20***)
Exchange Rate vs. USD	3.45***	-1.67**	-3.42**	64.07***	45.35***
	(1.80*)	(-10.76***)	(-10.14***)	(109.48***)	(107.21***)
REER	8.03***	0.64	-0.31	11.03	13.20
	(0.14)	(-14.66***)	(-15.31***)	(179.21***)	(178.32***)
GSCI	11.61***	-1.76*	-0.15	6.89	4.07
	(-1.29)	(-15.72***)	(-12.67***)	(144.85***)	(102.95***)
Brent	11.97***	-2.33**	-0.69	9.30	5.55
	(0.57)	(-14.91***)	(-12.97***)	(149.07***)	(125.26***)
Real GDP	12.98***	-1.04	0.77	6.89	2.81
	(-0.62)	(-13.47***)	(-12.99***)	(148.82***)	(182.55***)
VIX	1.51**	-2.10**	-1.80**	16.06*	15.98
	(-1.30)	(-20.77***)	(-17.94***)	(214.88***)	(230.05***)
M2 Aggregate	12.68***	1.00	3.87	0.47	0.20
	(-0.81)	(-1.88**)	(-4.26***)	(36.15***)	(40.19***)
Dom. Credit Aggregate	12.40***	0.12	2.75	1.11	1.95
	(-1.04)	(-7.34***)	(-8.57***)	(86.48***)	(92.10***)
FX Reserves Aggregate	11.76***	-2.31**	-1.00	11.25	6.78
	(3.52)	(-6.61***)	(-9.71***)	(101.67***)	(102.00***)

Chapitre 2 Portfolio Capital Flows: A Simple Coincident Indicator for Emerging Markets

Résumé non technique

Dans le **deuxième chapitre**, nous partons du constat que les investissements de portefeuille tendent à représenter une part de plus en plus importantes des flux de capitaux (IMF, 2011a et 2011b; Broner *et al.*, 2013) et que les données collectées par le FMI à travers la BdP souffrent de deux contraintes majeures : (i) une fréquence de publication relativement faible et (ii) un retard de publication significatif. Ce retard de publication peut être problématique que ce soit pour les décideurs politiques ou pour l'industrie de la gestion d'actifs (FMI, 2007 et 2011a ; Magud *et al.*, 2011 ; Forbes et Warnock, 2012). Pour les premiers, c'est un besoin de calibration de politiques plus appropriées qui est mis en avant, et ce, afin de contrôler les effets parfois pernicieux engendrés par la volatilité des investissements de portefeuille, *i.e.*, déséquilibres économiques et financiers résultant d'envolées (*surges*) et/ou arrêts brutaux (*sudden stops*) (FMI, 2011a et 2011b ; Broner *et al.*, 2013). Pour la seconde, le besoin de données plus fréquentes et plus robustes est nécessaire dans le but d'adopter un comportement de marché plus pertinent. Pour contourner ces problèmes, de nombreux *proxies* ont fait leur apparition dans la littérature académique (Calvo *et al.*, 2004 et 2008 ; Reinhart et Reinhart, 2009 ; Miao et Pant, 2012). Dans ce deuxième chapitre, nous proposons un *proxy* simple et coïncidant des investissements bruts de portefeuille de la BdP vers les ME. Cet indicateur utilise les données fournies par *Emerging Portfolio Fund Research* (EPFR) *Global* qui couvre les investissements de portefeuille sur les marchés obligataires et d'actions, notamment émergents. À travers un modèle à correction d'erreur, nous constatons que les tendances lourdes mises en avant via les données EPFR coïncident avec celles extraites des données de la BdP (Jotikasthira *et al.*, 2012), principalement pour les grands agrégats régionaux et les grands ME. Enfin, à la lumière de ces résultats, nous construisons des indices de sentiment des investisseurs qui fournissent des informations pertinentes sur les rendements des marchés obligataires et d'actions émergents.

2.1 Introduction

Since the early 2000s, capital flows to Emerging Markets (EMs) have risen massively. These large capital flows are theoretically profitable for the receiving countries. This huge increase is mainly explained by pull factors, *e.g.*, much stronger potential for economic growth and financial integration (Förster *et al.*, 2012). However, in practice, capital flow surges often end up in sudden stops and can carry some macroeconomic and financial imbalances, especially for EMs. These imbalances create challenges for policymakers and asset managers (IMF, 2007 and 2011a; Magud *et al.*, 2011; Forbes and Warnock, 2012). Since the global financial crisis of 2007-08, major central banks in Developed Markets (DMs) have considerably eased their monetary policies and provided some excess liquidity. This global excess liquidity revived international investors' risk appetite and willingness to search for yield behaviour, *i.e.*, push factors (Fratzscher, 2012). Since then, capital flows from DMs to EMs have bounced back (Fratzscher *et al.*, 2012) but, compared to pre-crisis waves of inflows, the post-crisis surge is characterised by an increasingly important part of portfolio flows. Moreover, the shift from foreign direct investments and cross-border bank lending towards portfolio flows seems to be structural in nature and implies some volatility (IMF, 2011a and 2011b; Broner *et al.*, 2013). These risks are mainly present in Emerging Asia and Latin America (Kaminsky and Reinhart, 1999; Berthaud *et al.*, 2011; IMF, 2011b; Ahmed and Zlate, 2013). Ultimately, monetary policy tightening is unavoidable in DMs in the medium term and the economic outlook in EMs turns out to be weaker than before, thus exacerbating the recent issues even more.

The post-crisis capital flow bonanza raises fears about the emergence of bubbles in asset prices, potential currency crises and the excessive growth of foreign exchange reserves. Furthermore, the last surge in capital flows is more volatile than ever (Mauro *et al.*, 2007). This volatility is mainly driven by the fickleness of foreign investors which is partly due to financial market contagion through cross-market rebalancing in portfolio flows (Kodres and Pritsker, 2002). In addition, the Balance of Payments (BoP) capital flows, collected by the International Monetary Fund (IMF), are the most commonly used source of cross-country data but BoP data have two major drawbacks: the data are (i) available at low frequency, *i.e.*, quarterly at best and (ii) published with lags of up to three quarters. These issues, related to the publication of BoP data, coupled with the volatility of portfolio investment, could hamper the prevention of some turmoil especially in EMs exchange rates and equity markets. Therefore, many proxies

appeared in the academic literature, to approximate net capital flows (Calvo *et al.*, 2004 and 2008; Reinhart and Reinhart, 2009) and gross portfolio capital flows[43] (Miao and Pant, 2012), *e.g.*, changes in foreign exchange reserves, capital tracker and coincident indicator.

In light of recent developments and concerns, we want to better understand foreign investors' sentiment measured by gross portfolio capital flows. Additionally, we are also looking for an indicator which can deal with and even circumvent BoP data weaknesses. To this end, we extend the framework of Miao and Pant (2012) who propose a composite coincident indicator for the liability side of BoP portfolio capital flows. This indicator is coincident in that it provides more frequent up-to-date information on cross-country portfolio flows using another database which is available three to nine months earlier than BoP data, namely the Emerging Portfolio Fund Research (EPFR) Global database. Among other things, EPFR provides weekly and monthly data on bond and equity flows for both DMs and EMs. Regarding the literature, there are very few papers that use the EPFR database. However, some of the largest international financial institutions such as the World Bank, the Bank of International Settlements, the IMF, the Organisation for Economic Co-operation and Development and some major central banks have been using EPFR data for many years. There are two papers[44] that are getting our attention. irst, Jotikasthira *et al.* (2012) uncovered a new channel through which financial shocks are transmitted across international markets using EPFR data. They showed that investor flows to funds domiciled in DMs force significant changes in portfolio allocations towards EMs. Second, Miao and Pant (2012) proposed a high frequency composite indicator based on EPFR data in order to track the foreign investors' sentiment on EM regional aggregates.

In an error correction framework, we analyse the links between EPFR country flows and BoP gross portfolio flows. The idea is to build a new simple coincident indicator for BoP gross portfolio flows both for EM regional aggregates and EMs themselves. The chapter first analyses the monthly EPFR country flows, and then compares, in a linear framework, these flows with the weekly country flows to better capture the short-term dynamics of foreign investors' sentiment. Even though EPFR data represent a

[43]Gross portfolio capital flows refer to changes in portfolio liabilities of residents to non-residents. In other words, these are net purchases of non-residents in the relevant country.

[44]To our knowledge, we can mention Jotikasthira *et al.* (2012), Fratzschzer (2012), Forbes *et al.* (2012), Raddatz and Schmukler (2012), Fratzscher *et al.* (2012), Lo Duca (2012), Miao and Pant (2012). Each of these papers addresses very different topics.

sample of total flows, our indicator outperforms a simple linear rescale of EPFR data in approximating the liability side of BoP portfolio capital flows. According to some robustness checks, our simple coincident indicator is relevant and accurate for regional aggregates as well as for large EMs. As a result, the EPFR based indicator is a convenient candidate for practitioners who would like to have a simple and coincident proxy for gross portfolio capital flows. Furthermore, the construction of Investor Sentiment indices give us some relevant information on EMs asset returns. Lastly, EPFR data can be studied with much more granularity, *e.g.*, origin of flows, type of fund, sector allocations, type of investor, currency, etc., and could therefore be very useful both for policy makers and asset managers.

The chapter is organised as follows: Section 2.2 introduces the data and presents in detail the emerging countries falling within the scope of our study. Section 2.3 aims at establishing the links between BoP portfolio investment and EPFR flows. We then outline how we build our simple coincident indicator. Section 2.4 presents empirical findings and robustness checks. We expose how this proxy could be practically used in Section 2.5. We conclude our findings in Section 2.6.

2.2 Data

The idea is to extract from the EPFR database, which contains fund flows, sector flows and country flows, the information usually taken from BoP portfolio investment. We use quarterly and monthly data for BoP and EPFR flows respectively. Our sample is a subsample of the 48 EMs covered in the IMF (2011a) capital flows policy paper. Initially, we removed the EMs with a very low weight compared to others. By doing this, we reduced the sample to 33 EMs. Furthermore, four EMs are excluded for data reasons: Malaysia, Morocco, Tunisia and Vietnam (*cf.* Appendix 2.1 for more details on the data availability). We gather quarterly data from the first quarter of 2005 to the fourth quarter of 2014. The 29 EMs in our sample represent the All EMs aggregate and are divided in four regional aggregates: eight in Emerging Asia, seven in Latin America, eleven in Emerging Europe, and three in Other EMs[45].

[45]Emerging Asia includes China, India, Indonesia, Korea, Pakistan, Philippines, Sri Lanka and Thailand; Latin America includes Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela; Emerging Europe includes Bulgaria, Croatia, Czech Republic, Hungary, Kazakhstan, Lithuania, Poland, Romania, Russia, Turkey and Ukraine; Other EMs include Israel, Lebanon and South Africa.

2.2.1 BoP portfolio capital flows

According to the sixth edition of the Balance of Payments and International Investment Position Manual[46] (IMF, 2010a), BoP portfolio investment:

1. is defined as cross-border transactions and positions involving debt or equity securities, other than those included in direct investment or reserve assets;
2. covers, but is not limited to, securities traded on organised or other financial markets;
3. usually involves financial infrastructure, such as a suitable legal, regulatory, and settlement framework, along with market-making dealers, and a sufficient volume of buyers and sellers;
4. is characterised by the nature of the funds raised, the largely anonymous relationship between the issuers and holders, and the degree of trading liquidity in the instruments.

These portfolio investments belong either to residents of a considered country, *i.e.*, foreign assets of investors in this country, or to non-residents, *i.e.*, liabilities of this country to foreign investors. Transactions are positive if they represent a capital inflow in this country and negative otherwise (if they represent an outflow of capital from this country). Therefore, to better capture the gross cross-country portfolio flows, we focus only on the liability side of the BoP portfolio capital flows.

In this chapter, we use quarterly consolidated BoP flows from BPM6. BoP bond and equity portfolio flows are available from Q1 2005 to Q4 2014 with a lag of one to three quarter(s) at best and for a limited number of EMs. Some countries such as Malaysia, Morocco and Vietnam do not have sufficient historical data to estimate a sustainable long-term relationship. In addition, Tunisia has been disregarded since the data are at best annual frequency statistics (*cf.* Appendix 2.1 for more details on data availability).

2.2.2 EPFR Global database

Emerging Portfolio Fund Research Global provides daily, weekly and monthly information about fund flows and asset allocations to build country flows and sector flows.

[46] Hereafter, we refer to this handbook with the conventional acronym BPM6.

EPFR covers 104 developed and emerging countries for equity funds and 108 countries for the bond flows database. There are a number of aspects to consider when using EPFR data:

1. Funds flows are net flows, *i.e.*, the investor contribution/redemption into the fund. These flows exclude portfolios' performance and currency fluctuations;
2. Asset allocation data tracks the country (sector) weights in the provided EPFR funds flows;
3. Country (sector) net flows are supposed to estimate the capital flows into and out of the EMs in question.

Table 5 provides a snapshot of the funds covered by EPFR. The funds are split into two broad asset classes: bond and equity funds. Within these asset classes, funds are classified according to the type and the domiciliation of treated financial products. The first glance at Table 5 shows that the EPFR bond and equity flows each represent more than USD 10,000 billion but with a substantially different number of funds. In addition, the over-representation of funds invested by the United States is already obvious.

In this chapter, we only consider country flows. Data are collected on a monthly basis directly from asset managers through EPFR. The provided flows come mainly from several major market jurisdictions and offshore domiciles including Australia, Austria, Canada, Channel Islands, France, Germany, Hong Kong SAR, Luxembourg, Switzerland, the United Kingdom and the United States. Furthermore, approximately half of total flows collected by EPFR come from the United States with a pronounced dichotomy between equity assets and bond securities. Some gross flows are collected from large EMs such as Korea, Indonesia, Brazil, Russia, etc.; but they represent only a tiny share of total flows. Thus, we can consider, without loss of generality, that the flows collected by EPFR are gross flows, only for EMs, because these flows mainly come from DMs and some tax havens.

In the EPFR database, the equity flows generally start in January 2000 and continue to December 2014. Bond flows begin in January 2004. In case of missing data for a period not exceeding three months, they are replaced by zero. When the same prob-

[47] Europe, the Middle East and Africa.

Table 5: Bond and Equity funds: EPFR database coverage

Note: The table provides a snapshot of the funds covered by EPFR on a monthly basis as of April 2014. The funds are split into two broad asset classes: bond and equity funds. Within these asset classes, funds are classified according to the type and the domiciliation of treated financial products. EPFR equity flows (USD 13,086 billion) are more represented than bond flows (USD 10,364 billion). Funds invested by the United States represent more than 40% of EPFR flows.

Fund Group	Number of Funds	Asset under Management (in USD billion)
Bond and Equity Funds	**56,599**	**23,450.11**
Bond Funds	**22,181**	**10,364.06**
Money Market	2,679	3,798.72
United States	5,271	2,699.35
Global	6,210	1,508.37
Balanced	2,436	1,387.91
High Yield	2,492	654.11
EMs	3,093	315.60
Equity Funds	**34,418**	**13,086.05**
United States	11,181	7,026.61
Global	9,826	3,533.27
Western Europe	5,233	1,195.71
Global EMs	2,297	551.41
Asia ex-Japan	2,948	381.53
Japan	1,115	220.05
Pacific	469	80.88
Latin America	533	44.00
EMEA[47]	816	52.59

lem occurs over a longer period, the country's asset class is removed from the study. Because of missing data, we expect some significant differences between EPFR and BoP flows for some periods and for some regions. For comparison to the BoP capital flows purposes, the monthly flows are aggregated to obtain quarterly flows, which are the same frequency as the BoP capital flows. Moreover, we cumulate BoP and EPFR quarterly flows over four quarters to smooth the series and have a better idea of the trend of portfolio flows towards EMs, *i.e.*, a proxy of foreign investors' sentiment.

2.3 A simple coincident indicator for gross portfolio capital flows

Using the EPFR database presented above, we propose a coincident and up-to-date indicator for BoP portfolio investment liabilities. This indicator is coincident in that it happens in tandem with BoP gross portfolio flows. In addition, the indicator is up-to-date in that it provides more frequent and updated information on cross-country

portfolio flows. Here, the aim is to estimate quarterly BoP bond and equity flows with data collected on EPFR which is more precisely country bond and equity monthly flows. It is important to note that the modeling proposed below has no theoretical and economic background. The objective is mainly to find strong empirical evidence of the coincident relationship between BoP and EPFR portfolio flows.

2.3.1 The coincidence between BoP and EPFR flows

Figure 2 shows a comparison between EPFR and gross BoP portfolio capital flows. As expected, the magnitude of EPFR flows is much smaller than BoP flows. More precisely, over the full sample period, the average share of EPFR capital flows in the gross BoP flows is 59% of BoP equity flows and 28% of BoP bond flows. Furthermore, EPFR data seem to be a coincident indicator of gross BoP portfolio capital flows for most time periods. For instance, the reduced correlation between BoP and EPFR portfolio flows during the pre-crisis period is mainly due to some mismatches between BoP and EPFR flows in Latin America. Table 6 provides information on the correlation between our two sources of portfolio flows for the All EMs aggregate for the full sample period and for the two sub-periods highlighted in Table 6, *i.e.*, Q1 2005 to Q3 2008 and Q4 2008 to Q3 2013 *(cf.* Appendix 2.2 for more details on the correlations between BoP and EPFR flows for each regional aggregate).

Table 6: Correlations between BoP and EPFR flows for All EMs

Note: The table shows that EPFR country flows tend to become increasingly correlated with BoP portfolio flows. This has been particularly true since the recent global financial crisis. Indeed, regarding the bond flows, the correlation increased from 60.6% before the crisis to 75.6% afterwards. However, the correlation between BoP and EPFR equity flows remains quite stable over the full sample period. We explain this by the fact that, over the full sample period, the average share of EPFR equity flows is more than a half of BoP equity flows, reflecting the long-term trend in correlation over time.

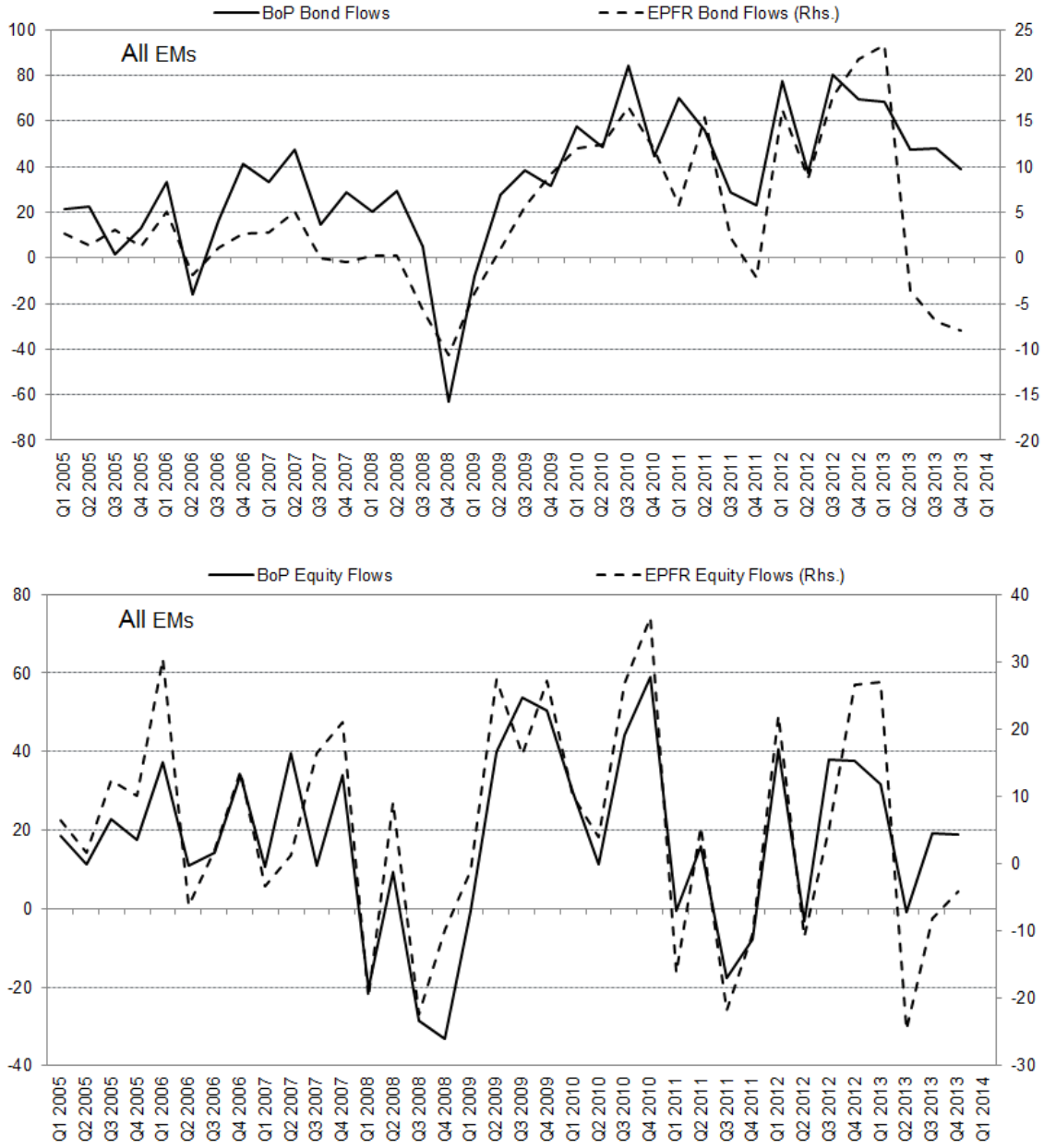
All EMs	Bond Flows	Equity Flows
Full Sample	**77.4%**	**85.3%**
Q1 2005 to Q3 2008	60.6%	82.0%
Q4 2008 to Q3 2013	75.6%	86.8%

2.3.2 Methodology

We consider the four-quarter moving sum of gross BoP and EPFR quarterly flows for bonds and equities. Over the entire sample period, *i.e.*, Q1 2005 to Q4 2014, BoP

Figure 2: Comparison of BoP and EPFR flows (USD billion)

Note: The figures plot the BoP portfolio capital flows (continuous line) and the EPFR country flows (dashed line). The upper graph concerns bond flows while the lower graph focuses on equity flows. As expected, the magnitude of EPFR flows is much smaller than BoP flows. More precisely, over the full sample period, the average share of EPFR capital flows in the gross BoP flows is 59% of BoP equity flows and 28% of BoP bond flows.



flows as EPFR flows are very volatile but the recent global financial crisis appears to present a break in these series. Thus, we start by testing the stationarity of the liability side of the BoP portfolio bond and equity flows as the gross bond and equity flows from EPFR with Augmented Dickey-Fuller (1981, ADF hereafter) and Phillips-Perron (1987 and 1988, PP hereafter) unit root tests[48]. In Table 7, we present the unit root tests results for regional aggregates and some large EMs in each of them. For more detailed results, especially in smaller EMs, *cf.* Appendix 2.3. Table 7 shows that in more than two thirds of cases, the series that we study are integrated of the same order, namely the order one. Then, we follow the Engle and Granger (1987) two-step procedure in order to know if cointegration relationships exist between our $I(1)$ variables. In a more detailed way, Table 7 brings us two lessons:

1. Overall, the larger the regional aggregates or EMs, the more BoP and EPFR flows have a propensity to have a common unit root;

2. Regarding the integration orders, there is a dichotomy between bond and equity flows. Indeed, bond flows have a higher propensity to have a unit root, while equity flows are more likely to be stationary in level.

To find out whether the series are cointegrated and as we are studying the cointegration with only one explanatory variable, we follow the Engle and Granger (1987) two-step procedure and, as a first step, we use the ADF and PP unit root tests on the estimated residuals from Ordinary Least Squares (OLS) regressions in (10) of BoP gross bond and equity flows over EPFR flows.

$$Y_{it} = [\alpha_i] + \beta_i X_{it} + \varepsilon_{it} \tag{10}$$

Considering that the relationship is on the estimated residuals and not on the "real" ones, we cannot refer to the usual Dickey-Fuller tables to conduct unit root tests. We have to look at the MacKinnon tables (MacKinnon, 1996). We provide the cointegration tests results in Table 8. As we expected, the series have a high propensity to be cointegrated because of the concomitant nature of BoP and EPFR flows[49]. For more

[48] The use of several tests to conclude on the nature of stationarity of the studied variables is essential to disambiguate on some test results. Indeed, the PP unit root tests differ from the ADF tests mainly in how they deal with serial correlation and heteroskedasticity in the errors. In particular, where the ADF tests use a parametric autoregression to approximate the ARMA structure of the errors in the test regression, the PP tests ignore any serial correlation in the test regression.

[49] As we mentioned earlier, the modeling proposed in this chapter has no theoretical and economic background. The

Table 7: Unit root tests results (ADF and PP) for BoP and EPFR flows

Note: The table presents the ADF (PP) t-statistics. The figures in bold reflect the ADF (PP) t-statistics in level. *, ** and *** denote rejecting the null hypothesis that there is a unit root at the 10%, 5% and 1% level of confidence, respectively. We show that in more than two thirds of cases, the series that we study are integrated of the same order, *i.e.*, $I(1)$.

Variable **Area/Country**	BoP Bond	EPFR Bond	BoP Equity	EPFR Equity
All EMs	-2.75*** (-2.79***)	-4,34*** (-3.17***)	-3.71*** (-3.79***)	**-2.36**** (-4.25***)
Emerging Asia	**-5.10***** (-2.68***)	-5.36*** (-2.84***)	**-2.76***** (-3.66***)	**-2.00**** (-4.09***)
China	-4.45*** (-4.66***)	**-5.19***** (-0.92)	-5.53*** (-4.54***)	**-4.12***** (-5.51***)
Indonesia	-4.52*** (-4.53***)	-5.30*** (-3.05**)	-3.26*** (-6.44***)	-5.57*** (-5.57***)
Latin America	-3.04*** (-3.11***)	-4.11*** (-3.34***)	-3.77*** (-3.77***)	-4.46*** (-4.46***)
Brazil	-5.44*** (-3.86***)	-4.37*** (-3.22***)	-3.51*** (-3.51***)	-4.53*** (-4.54***)
Emerging Europe	-3.49*** (-3.49***)	-3.91*** (-3.00***)	**-2.85***** **(-2.02**)**	**-3.01***** **(-2.02**)**
Turkey	-3.70*** (-3.70***)	-4.09*** (-2.87***)	-5.40*** (-4.80***)	**-2.26**** (-4.11***)
Other EMs	**-7.01***** (-4.02***)	-4.02*** (-3.79***)	**-2.52**** (-4.38***)	-4.14*** (-4.15***)
South Africa	**-4.05**** (-6.21***)	-1.68* (-3.91***)	**-2.20**** (-3.45***)	-4.49*** (-4.49***)

detailed results, especially for the smaller EMs, *cf.* Appendices 2.3 and 2.4.

When BoP and EPFR portfolio flows are cointegrated, we estimate, as a second step, an Error Correction Model (ECM) to capture both the long-term relationship and the short-term dynamics between our two sources of portfolio capital flows. The ECM is defined as follows:

$$\Delta Y_{it} = \gamma_i \Delta X_{it} + \delta_i \hat{\varepsilon}_{it-1} + \nu_{it} \tag{11}$$

where i denotes the different countries and regional aggregates, t denotes time, Y denotes the BoP gross portfolio capital flows, X denotes the EPFR flows, $\hat{\varepsilon}$ is the estimated residuals from the OLS regressions of Y on X in (10) and ν is the error term. According to the Granger representation theorem (Engle and Granger, 1987), the error correction

aim of this chapter is mainly to find strong evidence of the coincident relationship between BoP and EPFR portfolio flows. The well-known Engle and Granger (1987) two-step procedure allows us to empirically find out that our two sources of flows are cointegrated, which makes EPFR data a convenient proxy of BoP gross portfolio flows.

Table 8: Cointegration tests results (ADF and PP unit root tests on estimated residuals)

Note: The table presents the ADF (PP) t-statistics on the estimated residuals $\hat{\varepsilon}_{it} = Y_{it} - \hat{\beta}_i X_{it} - [\hat{\alpha}_i]$ where i denotes the different countries and regional aggregates, t denotes time, $\hat{\varepsilon}$ is the estimated error term from OLS regressions of BoP gross portfolio capital flows, Y, on EPFR flows, X, $\hat{\beta}$ is the estimated cointegrating coefficient and $\hat{\alpha}$ is the estimated intercept (only if it is statistically significant). The figures in bold reflect the ADF (PP) t-statistics on the estimated residuals in level. According to the first step of the Engle and Granger (1987) procedure, we have to compare these t-statistics with the critical values on MacKinnon tables (MacKinnon, 1996). *, ** and *** denote rejecting the null hypothesis that there is a unit root at the 10%, 5% and 1% level of confidence, respectively. OLS denotes the fact that we estimate the OLS regression $Y_{it} = [\alpha_i] + \beta_i X_{it} + \varepsilon_{it}$. In this case, we don't need to test the stationarity of the estimated residuals. We see that more than 70% of the series are cointegrated, almost 15% are estimated in a simple OLS framework while about 15% are not considered because the variables are not integrated of the same order or because there is no cointegration relationship. At this point, it is interesting to note that the series which are not considered are mainly equity flows, more specifically toward small EMs. In fact, it is difficult to establish a cointegration relationship (or at least a simple linear relationship) when BoP flows are low and therefore EPFR flows (which are a sample of total flows) are even lower for the smaller EMs of the study. For more detailed results, especially for the smaller EMs, *cf.* Appendices 2.3 and 2.4.

Variable **Area/Country**	$\hat{\varepsilon}_{it}^{Bond}$	$\hat{\varepsilon}_{it}^{Equity}$
All EMs	**-3.14***** **(-1.94*)**	**-1.95*** **(-1.95*)**
Emerging Asia	**-5.10***** **(-2.27**)**	**-2.49**** **(-1.72*)**
China	OLS	**-2.14**** **(-2.27**)**
Indonesia	**-2.91***** **(-2.81**)**	-2.71*** **(-2.66***)**
Latin America	**-4.67***** **(-2.01**)**	-2.10** **(-1.93*)**
Brazil	**-4.67***** **(-1.87*)**	**-2.25**** **(-1.74*)**
Emerging Europe	**-2.45**** **(-2.61**)**	OLS
Turkey	**-3.80***** **(-2.53**)**	**-2.07**** **(-2.33**)**
Other EMs	**-3.06***** **(-2.09**)**	-4.68*** (-4.68***)
South Africa	**-2.10**** **(-3.11***)**	**-5.01***** (-5.11***)

model includes variables in level and in variation. The use of the error correction model in the case of cointegration provides more reliable forecasts than if we only used the long-term relationship. Indeed, in a simple OLS framework which represents the long-term relationship, the estimated results are distorted by the non-stationarity of the series. In the OLS regressions $Y_{it} = [\alpha_i] + \beta_i X_{it} + \varepsilon_{it}$, we expect that BoP gross portfolio capital flows are positively associated with EPFR flows, *i.e.*, $\beta > 0$. In the ECM regressions in (11), we expect that an increase in BoP gross portfolio capital flows is associated with an increase in EPFR flows, *i.e.*, $\gamma > 0$. In addition, a long-run relationship exists between BoP gross portfolio capital flows and EPFR flows only if δ, which measures the speed of adjustment of the endogenous variable towards the equilibrium, is significantly negative.

2.4 A powerful coincident indicator

A powerful coincident indicator is an indicator which occurs almost exactly at the same time as the conditions they signify. In our case, the EPFR based indicator may explain well the trend in investors' sentiment as measured by the dynamic of quarterly BoP gross portfolio flows. However, there is a real dichotomy between bond and equity markets. Indeed, since the global financial crisis, we notice a diversification trend towards bond markets while this diversification in equity markets occurred earlier. Some robustness checks are also presented in this section. Estimates for small EMs[50] are discussed at the end of this section.

2.4.1 An up-to-date analysis for gross portfolio capital flows

We are using a two-step procedure. We provide the estimates for regional aggregates as a first step and we construct the EPFR based coincident indicator for the liability side of BoP portfolio capital flows as a second step.

Tables 9 and 10 summarise the regression results for portfolio bond and equity flows respectively. In Figures 3 and 4, we provide the evolution of our simple coincident indicator for bond and equity flows, respectively. In almost all cases, the simple coincident EPFR based indicator is powerful in approximating gross BoP bond and equity portfolio flows. The fact that our models fit quite well shows that our indicator is quite accurate. Indeed, the R^2 is about 0.56[51] on average and oscillates between 0.32 and

[50] Because of space limitation, the estimated results for small EMs are not reported but available upon request.
[51] The average R^2 takes into account only the estimates with significantly negative cointegrating coefficients.

Table 9: A coincident indicator for BoP portfolio bond flows

Note: The table presents the results of the ECM $\Delta Y_{it} = \gamma_i \Delta X_{it} + \delta_i \hat{\varepsilon}_{it-1} + \nu_{it}$ and the coefficient β of the OLS $Y_{it} = [\alpha_i] + \beta_i X_{it} + \varepsilon_{it}$. Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively. We want to emphasise that δ should be significantly negative. Otherwise, the ECM regression is not valid. Moreover, δ measures the speed at which prior deviations from equilibrium are corrected. Finally, if $X \rightsquigarrow I(d_1)$ and $Y \rightsquigarrow I(d_2)$ (with $d_1 \neq d_2$ and $d_j \in \mathbb{Z}^+$ for $j = \{1, 2\}$), then we do not estimate any model to avoid spurious regression because the variables which are integrated of a different order cannot be cointegrated. The R^2 oscillates between 0.32 for the Emerging Asia aggregate and 0.66 for the All EMs aggregate. For more detailed results on the larger EMs, *cf.* Appendix 2.5.

Dependent Variable: *D(BoP Bond)*
Q1 2006 - Q4 2014

Area / *Variable*	All EMs	Emerging Asia	excluding South Korea	Latin America	Emerging Europe	Other EMs
γ_i	2.304*** *(.362)*	1.962** *(.734)*	2.119*** *(.379)*	1.536*** *(.416)*	3.239*** *(.471)*	3.792*** *(.937)*
δ_i	-0.398*** *(.142)*	-0.201* *(.110)*	-0.134* *(.072)*	-0.253** *(.110)*	-0.419** *(.153)*	-0.236** *(.107)*
Long-term relationship						
β_i	3.495*** *(.245)*	2.631*** *(.564)*	3.876*** *(.394)*	3.400*** *(.379)*	4.074*** *(.272)*	2.290*** *(.683)*
Number of Observations	31	31	31	31	31	31
Adj. R-Squared	0.66	0.32	0.52	0.36	0.63	0.37

0.66 for bond flows and between 0.59 and 0.83 for equity flows. Note that the estimates for the larger aggregate, *i.e.*, All EMs, are the most accurate both for bond and equity flows because aggregated data for All EMs are available over the entire sample and with high variance, both for BoP and EPFR portfolio capital flows.

In all cases, an increase in the EPFR country flows is positively and significantly associated with an increase of BoP portfolio flows. Moreover, for All EMs, the response of BoP bond flows to an increase of one dollar in EPFR bond flows is around 2.3 dollars, while it is only around 1.4 dollars for equity flows. Besides, funds invested on equity markets are more represented in the EPFR database than funds invested in bond markets and thus this is the most important bias of the EPFR database. From a more statistical point of view, the coefficient δ always shows the expected sign. However, δ is not always significant as we can see in the case of Other EMs aggregate.

If we take a closer look at Emerging Asia, we note that South Korea may bias this regional aggregate. According to the classification criteria, South Korea is a country

Table 10: A coincident indicator for BoP portfolio equity flows

Note: The table presents the results of the ECM $\Delta Y_{it} = \gamma_i \Delta X_{it} + \delta_i \hat{\varepsilon}_{it-1} + \nu_{it}$ if any and the coefficient β of the OLS $Y_{it} = [\alpha_i] + \beta_i X_{it} + \varepsilon_{it}$. Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively. For the simple OLS regression, estimates are made between Q4 2005 and Q4 2012. We want to emphasise that δ should be significantly negative. Otherwise, the ECM regression is not valid. Moreover, δ measures the speed at which prior deviations from equilibrium are corrected. Finally, if $X \rightsquigarrow I(d_1)$ and $Y \rightsquigarrow I(d_2)$ (with $d_1 \neq d_2$ and $d_j \in \mathbb{Z}^+$ for $j = \{1, 2\}$), then we do not estimate any model to avoid spurious regression because the variables which are integrated of a different order cannot be cointegrated. The R^2 oscillates between 0.59 for the Emerging Asia excluding South Korea aggregate and 0.83 for the All EMs aggregate. For more detailed results on the larger EMs, *cf.* Appendix 2.5.

Dependent Variable: *D(BoP Equity)*
Q1 2006 - Q4 2014

Area / *Variable*	All EMs	Emerging Asia	excluding South Korea	Latin America	Emerging Europe	Other EMs
γ_i	1.381*** *(.115)*	1.426*** *(.174)*	1.039*** *(.176)*	0.996*** *(.176)*		2.114*** *(.401)*
δ_i	-0.287** *(.125)*	-0.314** *(.136)*	-0.267** *(.120)*	-0.268** *(.122)*		-0.063 *(.062)*
Long-term relationship						
β_i	1.644*** *(.128)*	1.835*** *(.179)*	1.271*** *(.222)*	1.238*** *(.214)*	0.952*** *(.247)*	1.117* *(.802)*
Number of Observations	31	31	31	31	32	31
Adj. R-Squared	0.83	0.69	0.59	0.61	0.32	0.48

which is sometimes considered as an EM and sometimes as a DM. In this case, the consideration we have made on the gross nature of EPFR flows no longer holds. Indeed, South Korean residents invest significantly abroad and EPFR data reflect this fact[52]. Furthermore, if we estimate the BoP gross bond flows for Emerging Asia removing South Korea, the coefficient δ remains significantly negative and the R^2 climbs from 0.32 to 0.52. However, if we do the same for BoP gross equity flows, δ remains significantly negative but the explanatory power of the regression decreases from 0.69 to 0.59. We explain this by the fact that, taken country by country, ECM estimates for gross equity flows in Emerging Asia are spurious in the case of India, Pakistan and Philippines, *i.e.*, the variables are integrated of a different order and cannot be cointegrated or the coefficient δ is not significant.

From an economic standpoint, we can identify three highlights from Figures 3 and 4:

[52] EPFR reports that, on average, more than 35% of gross equity flows are invested abroad and this share is about 15% for gross bond flows.

Figure 3: BoP bond flows (four-quarter moving sum) and EPFR coincident indicator (USD billion)

Note: The figures plot the four-quarter moving sum of BoP portfolio bond flows (continuous line) and the EPFR coincident indicator for bond flows (dashed line). Each figure reflects a different regional aggregate. According to the IMF terminology (2011a), we identify three global waves of capital inflows in the time interval we consider in this chapter: Q4 2006 to Q2 2008, Q3 2009 to Q4 2010 and Q1 2012 to Q1 2013. For more detailed results on the larger EMs, *cf.* Appendix 2.5.

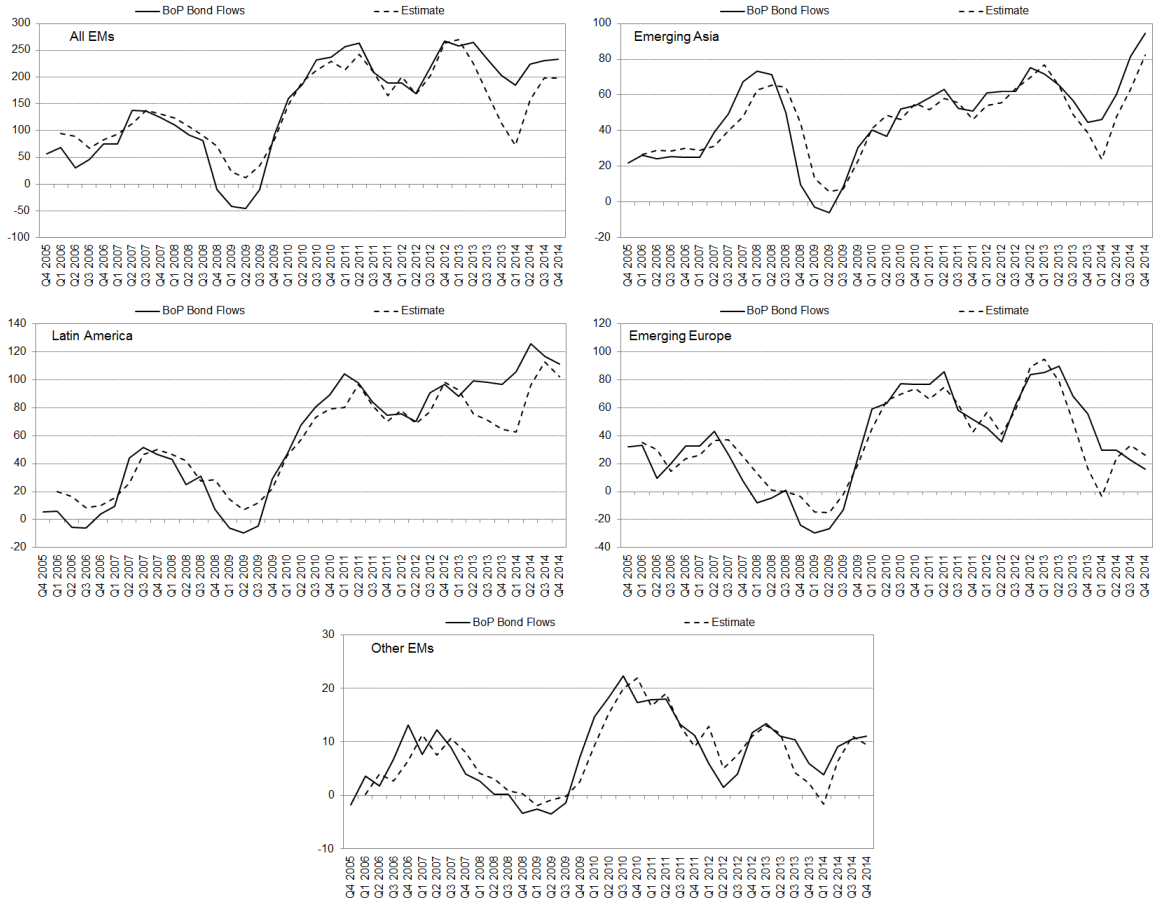
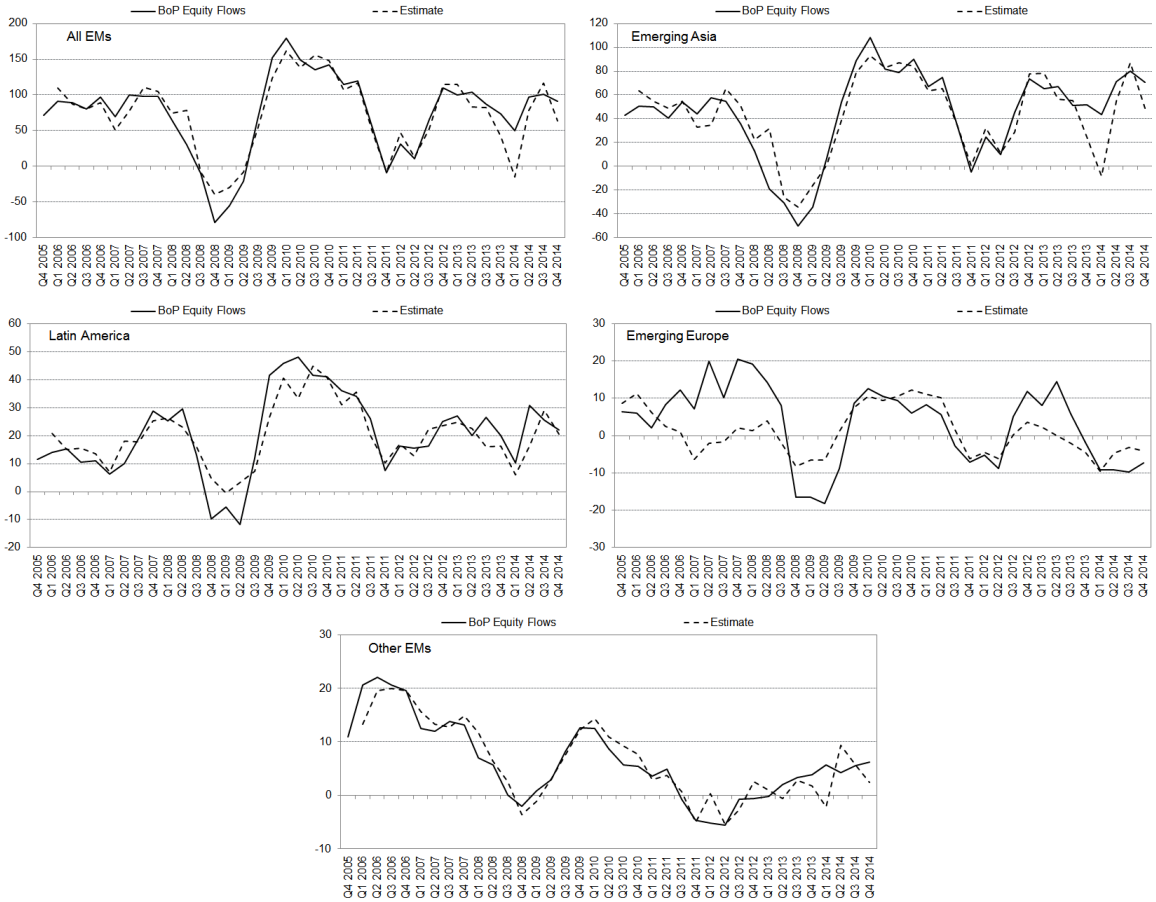


Figure 4: BoP equity flows (four-quarter moving sum) and EPFR coincident indicator (USD billion)

Note: The figures plot the four-quarter moving sum of BoP portfolio equity flows (continuous line) and the EPFR coincident indicator for equity flows (dashed line). Each figure reflects a different regional aggregate. According to the IMF terminology (2011a), we identify three global waves of capital inflows in the time interval we consider in this chapter: Q4 2006 to Q2 2008, Q3 2009 to Q4 2010 and Q1 2012 to Q1 2013. For more detailed results on the larger EMs, *cf.* Appendix 2.5.



1. The dynamics of BoP gross portfolio capital flows in each regional aggregate and, to a lesser extent, in large EMs, broadly follow the same path because these BoP flows follow a common story. Indeed, according to the IMF terminology (2011a), we identify three global waves[53] of capital inflows in the time interval we consider in this chapter: Q4 2006 to Q2 2008, Q3 2009 to Q4 2010 and Q1 2012 to Q1 2013.

2. The analysis slightly differs depending on the asset class we consider. In fact, the appetite for EM assets began in the 1990s and initially concerned the equity markets which were deeper and more liquid than bond markets, which barely existed at that time. In the 2000s, the emerging bond markets expanded greatly and investors tended to diversify their portfolios. This led to the first wave of capital inflows we are considering, *i.e.*, Q4 2006 to Q2 2008. The second and third waves of inflows have been more a matter of search for yield after the global financial crisis and the attractiveness for emerging bond markets continued to strengthen during these periods.

3. During the second wave of capital inflows, the search for yield has not been without selectivity. Indeed, in terms of dynamics and amounts, on the emerging equity markets, Latin America and Emerging Asia were preferred to Emerging Europe and Other EMs while on the emerging bond markets, Latin America and Emerging Europe were preferred to Emerging Asia and Other EMs.

2.4.2 Robustness checks: how good is our coincident indicator?

We have shown that our coincident indicator was performing well in-sample but we must ensure that the regression results are robust and relevant making some out-of-sample forecasts and tracking error measurements.

2.4.2.1 Out-of-sample forecasts

Here, we perform some validity tests of our EPFR based coincident indicator. We want to know if it can help us to predict the magnitude of actual BoP gross portfolio capital flows in a real time framework. For this purpose, we estimate rolling regressions to generate one-quarter-ahead out-of-sample forecasts for BoP portfolio flows. We

[53] In the IMF terminology (2011a), surges, episodes and waves are defined: (i) a surge refers to a quarter or a year during which gross inflows significantly exceed their long-run trend and are also large in absolute magnitude; (ii) an episode of capital inflows refers to a prolonged surge and (iii) a wave of capital inflows refers to a large number of country episodes occurring at the same time.

apply our simple coincident indicator in a real time setting between Q2 2010 and Q3 2013[54] when most EMs in our sample have experienced both surges and sudden stops in gross portfolio flows. We start by estimating our model up to Q1 2010 and compute their one-quarter-ahead forecast for BoP gross portfolio capital flows in Q2 2010. We perform this recursively by moving the estimation and forecast windows one quarter ahead to obtain the real time forecasts for each quarter between Q3 2010 and Q3 2013.

In Figure 5, we compare our simple coincident indicator with its one-period-ahead forecast for the All EMs aggregate. We can highlight three main conclusions from this application:

1. Out-of-sample forecasts track almost perfectly with the EPFR based coincident indicator estimated over the full sample period. Indeed, the values of the coefficients for the one-period-ahead forecasts remain very close to those of the estimated coefficients on the whole sample. This first result attests to the robustness of the regression results;
2. As for the simple coincident indicator derived over the full sample period, the one-quarter-ahead forecasts are closely aligned with the realised BoP gross portfolio capital flows that the IMF provides subsequently. This supports the relevance of our EPFR based coincident indicator and confers upon it an up-to-date capacity;
3. Based on the recent data available for the All EMs aggregate, our coincident and up-to-date EPFR based indicator projects a significant decrease of bond and equity flows toward EMs. Moreover, this decline is expected to stabilise in light of the latest data provided by EPFR.

More broadly, the out-of-sample forecasts for other regional aggregates as for large EMs are very robust and allow us to draw the same conclusions as for the All EMs aggregate.

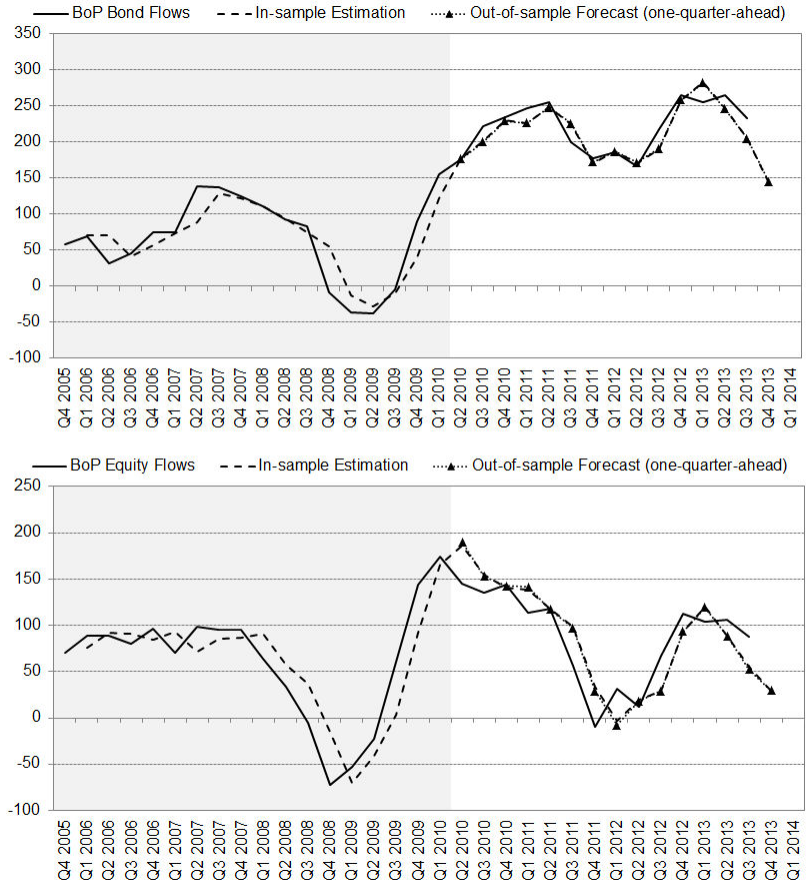
2.4.2.2 Tracking error measurements

In order to get a more precise idea of the forecast accuracy of our EPFR based coincident indicator, we compute four tracking error measurements. The Mean Absolute

[54] As we have seen before, estimates of BoP gross bond flows for China and estimates of BoP gross equity flows for Emerging Europe are conducted in an OLS framework. Therefore, both estimates and computations of out-of-sample forecasts begin in Q1 2010.

Figure 5: One-period-ahead forecasts of the EPFR coincident indicator for All EMs (USD billion)

Note: The figures plot the four-quarter moving sum of BoP portfolio capital flows (continuous line), the in-sample estimation (dashed line) and the one-quarter-ahead out-of-sample forecast (dotted line with triangular markers). The shaded area corresponds to the in-sample period while the white area corresponds to the out-of-sample period. The upper graph concerns bond flows while the lower graph focuses on equity flows. Out-of-sample forecasts track almost perfectly with the EPFR based coincident indicator estimated over the full sample period. Furthermore, the one-quarter-ahead forecasts are closely aligned with the realised BoP gross portfolio capital flows that the IMF provides subsequently.



Error (MAE) or the Root Mean Square Error (RMSE) which are among the most commonly used absolute tracking error measurements[55], the Median Absolute Percentage Error (MdAPE) and the Normalised Root Mean Square Error (NRMSE)[56].

We summarise these tracking error measurements in Table 11. As we expected, the results of the two scale-dependent metrics, *i.e.*, MAE and RMSE, cannot be compared between multiple time series but these results are informative about the average and standard forecast errors in the scale of the time series, *i.e.*, in USD billion. Regarding the MdAPE and the NRMSE, we can draw several interesting conclusions:

1. Overall, when the MdAPE are small (respectively high), the NRMSE are also small (respectively high), reflecting the adequacy of these tracking error measures;
2. The larger the regional aggregates or the EMs, the smaller the MdAPE and the NRMSE, meaning that the larger the regional aggregates or the EMs, the more accurate the estimates;
3. The MdAPE and the NRMSE are smaller for bond flows than for equity flows. This emphasises that the estimates for bond flows are more accurate than for equity flows. Despite the fact that the average share of EPFR bond flows in the gross BoP bond flows is smaller than for equity flows, we argue that there are more EPFR data on emerging bond markets than on emerging equity markets. Indeed, EPFR equity flows are over-represented towards the United States, which tends to bias the sample.

Broadly speaking, we can reasonably say that the simple and coincident EPFR based indicator we propose in this chapter is very meaningful for regional aggregates and large EMs. In addition, the robustness checks support the accuracy of the regression results and the relevance of our EPFR based indicator. Furthermore, we have shown that estimates for bond flows are more accurate than for equity flows. However, one of the methodological limitation of this study is the relative lower accuracy of small EMs estimates. Indeed, the scale-independent tracking error measures for the smaller EMs of the sample are higher than those for the larger EMs. For instance, the equity

[55] The use of absolute or squared values prevents negative and positive errors from offsetting each other but since these two metrics are scale-dependent, none of them are meaningful to compare multiple time series which have different scales.

[56] These two metrics, *i.e.*, the MdAPE and the NRMSE, both have the advantage of being scale-independent, so we can use them to compare forecast performance between different time series.

Table 11: Tracking error measurements for our simple coincident indicator of gross portfolio flows

Note: Tracking error measurements are computed as follows: $MAE = \frac{1}{T}\sum_{t=1}^{T}\left|\hat{Y}_t - Y_t\right|$; $MdAPE = median\left\{\left|\frac{\hat{Y}_t - Y_t}{Y_t}\right|, t = 1, ..., T\right\}$; $RMSE = \sqrt{\frac{1}{T}\sum_{t=1}^{T}\left(\hat{Y}_t - Y_t\right)^2}$ and $NRMSE = \frac{RMSE}{max(Y_t) - min(Y_t)}$. The RMSE is always greater than or equal to the MAE and if we take the example of the All EMs aggregate, we can say that, for bond flows, the MAE is around USD 21.3 billion when the standard error (RMSE) is around USD 25.9 billion. Regarding the scale-independent measurements, the larger the regional aggregates or the EMs, the smaller the MdAPE and the NRMSE. For the All EMs aggregate, we can see that the MdAPE and the NRMSE are smaller for bond flows than for equity flows (MdAPE: 12% vs. 29% and NRMSE: 8% vs. 12%) reflecting the relative higher accuracy of bond flows estimates.

Error Measurements	**Bond**				**Equity**			
Area/Country	MAE	MdAPE	RMSE	NRMSE	MAE	MdAPE	RMSE	NRMSE
All EMs	21.3	12%	25.9	8%	24.1	29%	28.7	12%
Emerging Asia	7.2	14%	9.6	13%	17.8	32%	20.8	14%
China	1.5	56%	1.9	6%	5.6	20%	7.3	18%
India	2.2	59%	3.2	18%	7.1	43%	8.4	16%
Indonesia	1.8	17%	2.5	15%	0.7	41%	0.8	18%
South Korea	5.9	15%	8.8	14%	7.6	52%	9.0	12%
Pakistan	0.2	50%	0.3	16%	0.2	53%	0.3	11%
Philippines	1.2	30%	1.6	13%	0.4	46%	0.4	14%
Thailand	0.8	24%	1.0	8%	1.3	37%	1.6	15%
Latin America	8.2	15%	10.4	10%	564	19%	7.9	13%
Argentina	1.8	23%	2.5	15%	0.4	61%	0.5	23%
Brazil	5.0	34%	6.3	16%	5.0	30%	6.9	13%
Chile	1.2	33%	1.4	12%	0.6	24%	0.9	11%
Colombia	1.0	34%	1.2	12%	0.3	52%	0.4	11%
Mexico	3.9	16%	4.9	6%	2.1	64%	2.7	16%
Peru	0.3	22%	0.7	10%	0.1	59%	0.1	16%
Venezuela	1.3	45%	1.7	17%	8.7	15,879%	10.9	3,609%
Emerging Europe	8.4	18%	9.7	8%	7.7	84%	9.4	24%
Bulgaria	0.3	58%	0.4	15%	0.1	117%	0.1	16%
Croatia	0.6	53%	0.8	18%	0.2	83%	0.4	40%
Czech Republic	1.1	36%	1.5	15%	0.4	83%	0.4	21%
Hungary	2.1	39%	2.5	15%	0.7	86%	1.0	17%
Kazakhstan	1.8	44%	2.4	13%	0.7	110%	1.2	22%
Lithuania	0.5	46%	0.8	15%	0.1	103%	0.1	22%
Poland	2.6	29%	3.3	11%	0.9	38%	1.1	11%
Romania	1.1	59%	1.5	14%	0.1	65%	0.1	14%
Russia	2.2	28%	2.9	9%	4.2	70%	5.8	17%
Turkey	3.3	26%	4.3	9%	0.9	33%	1.1	15%
Ukraine	1.0	30%	1.3	11%	0.1	36%	0.2	8%
Other EMs	6.7	52%	8.2	19%	2.7	49%	3.5	13%
Israel	1.8	50%	2.5	13%	1.8	73%	2.2	23%
Lebanon	0.4	40%	0.6	15%	0.4	46%	0.5	29%
South Africa	2.5	50%	3.0	16%	2.5	50%	2.7	14%

flows estimates for Venezuela are the least relevant of our study. It is mainly due to the fact that there are few portfolio capital flows to those small EMs and even if there are some flows, EPFR provides them with a very low variance and, which makes the estimates of gross portfolio flows quite ineffective. Another reason is that both cyclical and structural pull factors, which typically refer to the relative attractiveness of the countries, are fewer and/or difficult to highlight for the smaller EMs in the sample, according to EPFR data only.

2.5 Applying the simple coincident indicator to gauge Investor Sentiment towards EMs

Conceptually, Investor Sentiment, also called Market Sentiment, may be defined as the aggregate attitude or appetite of the investment community at a given time toward a particular security or, in our case, toward a larger financial market. In other words, Investor Sentiment is the feeling or tone of a market as revealed through flows and/or price movements of the securities traded in that market. Brown and Cliff (2004) define Investor Sentiment as the excessive optimism or pessimism in a particular market while for Baker and Wurgler (2006), Investor Sentiment is the propensity to speculate. Here, we propose to measure Investor Sentiment towards EMs with our simple and coincident EPFR based indicator.

Box 1: Comparison of weekly and monthly EPFR country flows

The purpose of this Box is to compare the monthly EPFR country flows with the highest frequency of country flows available on EPFR, *i.e.*, the weekly frequency. Actually, the EPFR database coverage is somewhat different because there are fewer funds covered (and hence fewer flows) on a weekly basis than on a monthly basis. To this end, we aggregate the weekly data to obtain monthly data from January 2005 to September 2013. According to ADF and PP unit root tests, the series are stationary in level and, therefore, we estimate the following OLS:

$$Y_{it} = \beta_i X_{it} + \varepsilon_{it} \tag{12}$$

where i denotes the different countries and regional aggregates, t denotes time, Y denotes the monthly EPFR country flows, X denotes the monthly aggregate EPFR country flows and ε is the error term.

Appendix 2.6 presents the results of the OLS in (12). As we can see, weekly and monthly EPFR country flows are quite comparable. Indeed, the R^2 oscillates around 0.90 and the scale factor (represented by the coefficient β which is always significant) is fairly stable both for bond and equity flows. β varies between 1.4 and 1.6 for bond flows while it varies between 1.1 and 1.2 for equity flows. Overall, monthly bond flows represent about 1.5 times the monthly aggregate bond flows, whereas monthly equity flows represent about 1.15 times the monthly aggregate equity flows. Without loss of generality, it appears that the weekly EPFR country flows provide relevant information for practitioners who would like to approximate BoP gross portfolio capital flows in a real time framework. Moreover, the weekly EPFR country flows are available each week with only one week's delay. Consequently, rolling the time window and applying the different scale factors gives us relevant and accurate estimates of monthly EPFR country flows with a higher frequency than the monthly EPFR country flows.

2.5.1 Investor Sentiment towards EMs

As mentioned above, Investor Sentiment may be measured through flows and/or price movements of the securities traded in a particular market. Obviously, in the case

of our study, we focus on EPFR portfolio flows to develop some indices reflecting the investor appetite for EMs. Before building some Investor Sentiment indices based on weekly data, we want to ensure that weekly and monthly EPFR country flows are comparable because EPFR database coverage is somewhat different on a weekly basis than on a monthly basis. We compare these two data frequencies in Box 1.

Since weekly and monthly EPFR country flows are comparable, we provide a simple way to build Investor Sentiment indices towards the largest regional aggregate of this study, *i.e.*, the All EMs aggregate, for different types of assets. As a first step, we need to detrend the series to better capture the cyclical trend in investors' sentiment. In fact, the purpose is to remove the trend component of the time series which are the weekly EPFR country flows for bond, equity and the sum of bond and equity flows[57]. Knowing that the trend is not supposed to be linear, we decide to use a Hodrick-Prescott filter (Hodrick and Prescott, 1997) to remove this nonlinear trend. Given that we use weekly data, Hodrick and Prescott (1997) suggest using a smoothing parameter value of 270,400[58]. In a second step, to better compare each Investor Sentiment index, we compute a standard score (z-score) with learning effect. In other words, at each date t and for each EPFR detrended flow, we remove the average from $t = 0$ to t and we then divide by the standard deviation from $t = 0$ to t. The All EMs investor sentiments are reflected in Figure 6[59].

In the first chart of Figure 6, we can highlight several important events that have rocked EMs. Indeed, if we focus on All EMs Investor Sentiment index deteriorating below two standard deviations, we can describe four periods of heavy stress:

1. Mid-2006: Rising inflation concerns and tightening by major central banks had a marked impact on financial markets between March and June. There was a more general retreat from equity markets and emerging market currencies in May and June.

2. Early 2007 to early 2008: This period has been characterised by many questions

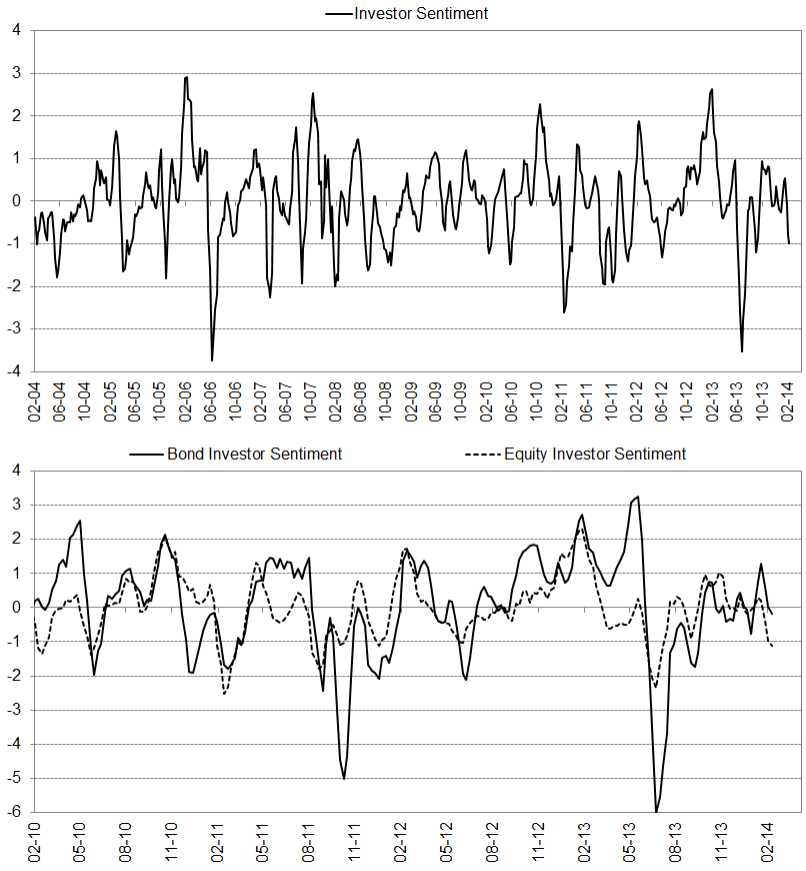
[57] The EPFR All EMs aggregate is composed of more than 90 EMs but the trend in this aggregate is virtually the same as our All EMs aggregate, which is composed of 27 major EMs.

[58] The value of the smoothing parameter λ is computed using the frequency power rule of Ravn and Uhlig (2002) which corresponds to the number of periods per year divided by 4 raised to a power value and multiplied by 1600. Although Ravn and Uhlig (2002) recommend using a power value of 4, we prefer to use a power value of 2, yielding the original Hodrick and Prescott (1997) values. Having said that, using a power value of 4 brings us to virtually similar results.

[59] For the sake of greater clarity and readability, the All EMs Investor Sentiment indices are smoothed using a four-week moving average. However, notably for the Granger non-causality tests (Granger, 1969), we use the unsmoothed Investor Sentiment indices to assess the coincident nature of our simple high frequency indicator.

Figure 6: All EMs Investor Sentiment indices (four-week moving average)

Note: The figures plot the four-week moving average of the All EMs Investor Sentiment indices. The upper graph concerns the sum of bond flows and equity flows for the All EMs aggregate while the lower graph focuses on each asset classes. If we focus on the All EMs Investor Sentiment index deteriorating below two standard deviations in the upper graph, we can describe four periods of heavy stress: (i) mid-2006, (ii) early 2007 to early 2008, (iii) early 2011 and (iv) mid-2013.



and concerns about the sustainability of the real estate market in the United States (see Dungey *et al.* (2013) for a detailed study on the misevaluation of risk in subprime-related mortgage-backed securities during the global financial crisis). In February 2007, HSBC, one of the world's largest banks, wrote down its holdings of subprime-related mortgage-backed securities by USD 10.5 billion. By April 2007, over 50 mortgage companies had declared bankruptcy. In July 2007, two Bear Stearns hedge funds collapsed.

3. Early 2011: Although the implementation of stimulus measures in 2009 had resulted in a rebound in economic activity in EMs in 2010, this economic activity

slowed significantly in 2011. This slowdown was partly driven by economic factors, both internal (domestic demand particularly weak) and external (drop in exports due to a lower demand from DMs, end of the second wave of the Federal Reserve Quantitative Easing). In addition, structural factors had also played in this downturn. The potential growth of EMs had declined, particularly for China.

4. Mid-2013: May 22, 2013, the Federal Reserve publicly described conditions for scaling back and ultimately ending its highly accommodative monetary policy (better known as "Fed Tapering"). Some EMs subsequently experienced sharp reversals of capital inflows, resulting in sizable currency depreciation.

From a practical point of view, Investor Sentiment indices help us to better understand the investment dynamic towards EMs. Moreover, Investor Sentiment indices may be a good contrarian predictor as they indicate significant events[60]. We can therefore ask ourselves if All EM Investor Sentiment indices are correlated with EM market returns and, when appropriate, if such indices cause these returns.

2.5.2 The link between Investor Sentiment indices and EM asset returns

There is a long-running debate in financial economics about the possible effects of Investor Sentiment on asset prices. The literature on this subject is abundant and we just want to point out that, according to Neal and Wheatley (1998) and Ben-Rephael *et al.* (2012), Investor Sentiment correlates strongly with contemporaneous asset returns but not with future returns (Brown and Cliff, 2004). However, according to Lemmon and Portniaguina (2006) and Baker and Wurgler (2006 and 2007), Investor Sentiment correlates with next period returns but only for smaller and younger stocks. Lastly, according to Baker *et al.* (2012), private capital flows appear to be one mechanism by which sentiment spreads across markets and forms global sentiment. Therefore, we want to know if our All EM Investor Sentiment indices, *i.e.*, All EM Investor Sentiment index as a whole, All EM bond Investor Sentiment index and All EM equity Investor Sentiment index, are linked to EM asset returns. To achieve this, we proceed in two steps. Initially, we start by testing the correlations between our All EM Investor Sentiment indices and EM asset returns, namely equity, bond and foreign exchange markets. Secondly, we want to find out if our All EM Investor Sentiment indices cause the returns of such markets. Since macroeconomic surprises are theoretically supposed to

[60] However, we have to keep in mind that, even in case of important events, a matter of weeks and even months will be required for the market to move in the contrarian direction.

have an impact on asset returns, we include the Citigroup Economic Surprise Index for EMs[61] (CESI-EM hereafter) for comparison purposes. Each EM asset class, *i.e.*, equity, bond and foreign exchange markets, is approximated by the most common and relevant indices. We use the Morgan Stanley Capital International Emerging Markets index in local currencies[62] (MSCI-EM hereafter) for EM equity markets, the J. P. Morgan Government Bond Index Emerging Markets Global Diversified[63] (GBI-EM hereafter) for EM local bond markets and the Morgan Stanley Capital International Emerging Markets Currency [USD] index[64] (MSCI-EM-Currency hereafter) for EM foreign exchange markets.

As discussed previously, we want to know if our All EM Investor Sentiment indices and the CESI-EM are correlated with the MSCI-EM, the GBI-EM and the MSCI-EM-Currency. Since we use weekly data, we build long-term rolling correlations, *i.e.*, 52 weeks, between All EM Investor Sentiment indices/CESI-EM and the weekly performances of MSCI-EM, GBI-EM and MSCI-EM-Currency from January 2005 to January 2014. We summarise the average of the 52-week rolling correlations over this period in Table 12. We want to highlight the fact that the All EM Investor Sentiment indices are more correlated with asset returns than the CESI-EM. Interestingly, the All EM bond (equity) Investor Sentiment index is more correlated with the GBI-EM (MSCI-EM) than the All EM Investor Sentiment index as a whole.

Table 12: Average of 52-week rolling correlations between Investor Sentiment indices and asset returns

Note: The table presents the average of 52-week rolling correlations between the four-week moving average of the All EMs Investor Sentiment indices/CESI-EM and the MSCI-EM, GBI-EM and MSCI-EM-Currency four-week moving average performances from January 2005 to January 2014. The figures in bold correspond to the correlations that we want to study in more details. In this respect, we see that the correlation between the All EMs Investor Sentiment index as a whole and the MSCI-EM is very high (59.3%) as well as the correlation with the MSCI-EM-Currency (50.6%). Interestingly, the All EMs equity Investor Sentiment index is more correlated with the MSCI-EM (60.8%) than the All EMs Investor Sentiment index as a whole. Moreover, we can draw the same conclusions about the correlation between the All EMs bond Investor Sentiment index and the GBI-EM (21.5% is greater than 21.2%).

	CESI-EM	**Investor Sentiment**	**Bond Investor Sentiment**	**Equity Investor Sentiment**	MSCI-EM	GBI-EM	MSCI-EM-Currency
CESI-EM	100%						
Investor Sentiment	2.2%	100%					
Bond Investor Sentiment	-3.6%	70.8%	100%				
Equity Investor Sentiment	2.7%	98.3%	58.4%	100%			
MSCI-EM	1.9%	**59.3%**	**31.8%**	**60.8%**	100%		
GBI-EM	-5.0%	**21.2%**	**21.5%**	**19.0%**	36.6%	100%	
MSCI-EM-Currency	8.0%	**50.6%**	**34.5%**	**50.1%**	73.1%	48.1%	100%

In the light of the above, we want to test if our All EM Investor Sentiment indices cause the performances of equity, bond and foreign exchange markets. To this end, we

[61] The Citigroup Economic Surprise Indices are objective and quantitative measures of economic news. They are defined as weighted historical standard deviations of data surprises. The indices are calculated daily in a rolling three-month window. The weights of economic indicators are derived from relative high-frequency spot FX impacts of one standard deviation data surprises. The indices also employ a time decay function to replicate the limited memory of markets. A positive reading of the Economic Surprise Index suggests that economic releases have on balance beaten consensus. The CESI for EMs is composed of 20 emerging countries: Brazil, Chile, China, Colombia, Czech Republic, Hong Kong, Hungary, India, Indonesia, Malaysia, Mexico, Singapore, South Korea, Peru, Philippines, Poland, South Africa, Taiwan, Thailand and Turkey.

[62] The MSCI-EM index is a free float-adjusted market capitalization index that is designed to measure equity market performance of EMs. As of February 2014, the MSCI-EM index consists of the following 21 EM country indices (weights): Brazil (9.9%), Chile (1.6%), China (19.9%), Colombia (1%), Czech Republic (0.3%), Egypt (0.2%), Greece (0.6%), Hungary (0.2%), India (6.3%), Indonesia (2.5%), Korea (16%), Malaysia (3.9%), Mexico (5.3%), Peru (0.5%), Philippines (1%), Poland (1.8%), Russia (5.9%), South Africa (7.4%), Taiwan (11.9%), Thailand (2.3%) and Turkey (1.5%).

[63] The GBI-EM Global Diversified is the most widely used index to capture a diverse set of EMs that most investors can access and replicate through bonds or derivatives. It includes all eligible countries regardless of capital controls and/or regulatory and tax hurdles for foreign investors. The index incorporates a constrained market-capitalization methodology in which individual issuer exposures are capped at 10%, (with the excess distributed to smaller issuers) for greater diversification among issuing governments. As of December 2013, the following 16 EMs were part of the GBI-EM Global Diversified index (weights): Brazil (10%), Chile (0.1%), Colombia (3.4%), Hungary (6.2%), Indonesia (6.9%), Malaysia (10%), Mexico (10%), Nigeria (2%), Peru (1.7%), Philippines (0.5%), Poland (10%), Romania (1.5%), Russia (10%), South Africa (10%), Thailand (8%), and Turkey (9.5%).

[64] The MSCI-EM-Currency index is the first and only currency index available that sets the weights of each currency equal to the relevant country weight in the MSCI-EM index (*cf.* weights for MSCI-EM). This unique approach to weighting the currencies allows creators of index-linked products to construct investment vehicles that can be used as an efficient and convenient way to enhance or hedge currency exposure to the MSCI-EM index.

perform Granger non-causality tests (Granger, 1969) to find out if our All EM Investor Sentiment indices Granger-cause asset returns. After ascertaining that our variables are stationary (ADF and PP tests), we use Akaike information criterion and Schwarz information criterion to determine the optimal number of lags that would need to be considered. The most relevant results suggest that the All EMs Investor Sentiment index, like the All EMs equity Investor Sentiment index, Granger-cause the return of MSCI-EM[65] and the All EMs bond Investor Sentiment index Granger-causes the return of GBI-EM. However, neither the CESI-EM nor the All EMs Investor Sentiment indices Granger-cause the return of MSCI-EM-Currency.

2.6 Conclusion

Using the EPFR Global database, this chapter provides an accurate measure of the liability side of BoP portfolio capital flows both for EM regional aggregates and EMs themselves. Contrary to BoP data, EPFR country flows are available three to nine months earlier and with a higher frequency. In an error correction framework, we show that an increase in the EPFR country flows is positively and significantly associated with an increase of BoP portfolio flows. Regarding the All EMs aggregate, the response of BoP bond flows to an increase of one dollar in EPFR bond flows is around 2.3 dollars, while it is around 1.4 dollars for equity flows. The approach here aims to simplify the existing framework on the approximation of the BoP portfolio capital flows. Against this background, the construction of Investor Sentiment indices with our simple coincident EPFR based indicator provides us some relevant information on EM asset returns. Overall, we demonstrate that the simple coincident EPFR based indicator is a convenient candidate to practitioners who would like to proxy BoP gross portfolio capital flows in a real time setting, notably using weekly EPFR data. Lastly, EPFR data can be studied with much more granularity, *e.g.*, origin of flows, type of fund, sector allocations, type of investor, currency, etc., and represent a useful data source both for policy makers and asset managers.

The brief application of Investor Sentiment indices discussed in this chapter allows us to open up new research avenues. Indeed, with the United States' escape from QE

[65] As part of our research and at the request of Amundi Asset Management, we have used these Investor Sentiment indices notably in order to build some asset allocation rules on emerging equity markets on a monthly basis since the early 2000s. The more the Investor Sentiment index of a given EM is high, the more its relative weight is high in the MSCI-EM in local currencies and *vice-versa*. The MSCI-EM is composed of 21 EMs and according to our asset allocation rules, our portfolio outperforms the MSCI-EM benchmark and a simple equally weighted portfolio. The annualised performance of our portfolio is 9.8% (*vs.* 7.4% for the MSCI-EM and 9.5% for the equally weighted portfolio) and the annualised volatility is 14.1% (*vs.* 18.1% for the MSCI-EM and 17.2% for the equally weighted portfolio).

and the start of a new monetary tightening cycle undertaken by the Fed, the United States bond market would attract the international capital flows originally flowed to EMs to reversely flow to the United States, so that the USD may appreciate and the EMs currencies may depreciate. In such case, the currency depreciation could accelerate the capital outflow, which further worsened the economic situation and international balance of payment. Future researchers could study the impacts of capital outflows throughout EPFR data on EMs currency depreciation.

Appendix 2.1: sample coverage of BoP and EPFR portfolio capital flows

Note: The table shows the detailed availability of gross BoP capital flows and EPFR country flows. Some countries such as Malaysia, Morocco and Vietnam do not have sufficient historical data to estimate a sustainable long-term relationship. In addition, Tunisia has been disregarded since the data are at best annual frequency statistics.

	Country	**BoP Flows (Liabilities)**		**EPFR Flows**	
		Bond	Equity	Bond	Equity
Emerging Asia	China	2005Q1-2014Q4	2005Q1-2014Q4	2004M1-2014M12	2000M1-2014M12
	India	2005Q1-2014Q4	2005Q1-2014Q4	2004M3-2014M12	2000M1-2014M12
	Indonesia	2005Q1-2014Q4	2005Q1-2014Q4	2004M1-2014M12	2000M1-2014M12
	Korea	2005Q1-2014Q4	2005Q1-2014Q4	2004M1-2014M12	2000M1-2014M12
	Malaysia	2005Q1-2009Q4	2005Q1-2009Q4	2004M1-2014M12	2000M1-2014M12
	Pakistan	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Philippines	2005Q1-2014Q4	2005Q1-2014Q4	2004M1-2014M12	2000M1-2014M12
	Sri Lanka	-	2005Q1-2014Q4	2004M11-2014M12	2000M1-2014M12
	Thailand	2005Q1-2014Q4	2005Q1-2014Q4	2004M1-2014M12	2000M1-2014M12
	Vietnam	-	2005Q1-2014Q4	2004M1-2014M12	2000M1-2014M12
Latin America	Argentina	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M312	2000M1-2014M12
	Brazil	2005Q1-2014Q4	2005Q1-2014Q4	2003M11-2014M12	2000M1-2014M12
	Chile	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Colombia	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Mexico	2005Q1-2014Q4	2005Q1-2014Q4	2004M3-2014M12	2000M1-2014M12
	Peru	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Venezuela	2005Q1-2014Q3	2005Q1-2014Q3	2004M4-2014M12	2000M1-2014M12
Emerging Europe	Bulgaria	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Croatia	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Czech Republic	2005Q1-2014Q4	2005Q1-2014Q4	2003M11-2014M12	2000M1-2014M12
	Hungary	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Kazakhstan	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M3	2004M4-2014M12
	Lithuania	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Poland	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Romania	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Russia	2005Q1-2014Q4	2005Q1-2014Q4	2003M11-2014M12	2000M1-2014M12
	Turkey	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
	Ukraine	2005Q1-2014Q4	2005Q1-2014Q4	2004M4-2014M12	2000M1-2014M12
Other EMs	Israel	2005Q1-2014Q4	2005Q1-2014Q4	2005M1-2014M12	2000M1-2014M12
	Lebanon	2005Q1-2014Q2	2005Q1-2014Q2	2005M6-2014M12	2000M1-2014M12
	Morocco	-	2005Q1-2011Q4	2004M4-2014M12	2000M1-2014M12
	South Africa	2005Q1-2012Q4	2005Q1-2012Q4	2003M11-2014M12	2000M1-2014M12
	Tunisia	-	-	2004M4-2014M12	2000M1-2014M12

Appendix 2.2: correlations between BoP and EPFR flows for regional aggregates

Note: The table shows that EPFR country flows tend to become increasingly correlated with BoP portfolio flows. This has been particularly true since the recent global financial crisis. Indeed, regarding the bond flows, the correlation increased from 60.6% before the crisis to 75.6% afterwards. However, the correlation between BoP and EPFR equity flows remains stable over the full sample period. We explain this by the fact that, over the full sample period, the average share of EPFR equity flows is more than a half of BoP equity flows, reflecting the long-term trend in correlation over time.

Emerging Asia	Bond Flows	Equity Flows
Full Sample	**55.9%**	**74.8%**
Q1 2005 to Q3 2008	39.7%	54.2%
Q4 2008 to Q3 2013	61.8%	83.9%

Latin America	Bond Flows	Equity Flows
Full Sample	**48.4%**	**76.8%**
Q1 2005 to Q3 2008	33.0%	86.5%
Q4 2008 to Q3 2013	42.7%	76.2%

Emerging Europe	Bond Flows	Equity Flows
Full Sample	**74.2%**	**59.5%**
Q1 2005 to Q3 2008	50.4%	58.0%
Q4 2008 to Q3 2013	76.4%	64.5%

Other EMs	Bond Flows	Equity Flows
Full Sample	**46.0%**	**43.2%**
Q1 2005 to Q3 2008	42.6%	59.6%
Q4 2008 to Q3 2013	52.1%	40.6%

Appendix 2.3: unit root tests results (ADF and PP) for BoP and EPFR flows

Note: The table presents the ADF (PP) t-statistics. The figures in bold reflect the ADF (PP) t-statistics in level. *, ** and *** denote rejecting the null hypothesis that there is a unit root at the 10%, 5% and 1% level of confidence, respectively. We show that in more than two thirds of cases, the series that we study are integrated of the same order, *i.e.*, $I(1)$.

Area/Country	BoP Bond	EPFR Bond	BoP Equity	EPFR Equity
All EMs	-2.75***	-4,34***	-3.71***	**-2.36****
	(-2.79***)	(-3.17***)	(-3.79***)	(-4.25***)
Emerging Asia	**-5.10*****	-5.36***	**-2.76*****	**-2.00****
	(-2.68***)	(-2.84***)	(-3.66***)	(-4.09***)
China	-4.45***	**-5.19*****	-5.53***	**-4.12*****
	(-4.66***)	(-0.92)	(-4.54***)	(-5.51***)
India	-4.38***	**-2.44****	-5.97***	**-2.03****
	(-1.96)**	(-2.06**)	-3.53***	**(-2.03**)**
Indonesia	-4.52***	-5.30***	-3.26***	-5.57***
	(-4.53***)	(-3.05***)	(-6.44***)	(-5.57***)
South Korea	**-4.57*****	-6.26***	**-2.33****	**-2.32****
	(-2.21***)	(-2.37**)	(-3.66***)	(-3.75***)
Pakistan	-6.41***	-4.19***	**-3.70****	**-2.10****
	(-6.41***)	(-3.87***)	(-3.37***)	(-3.90***)
Philippines	-4.52***	-4.88***	**-2.17****	-2.89***
	(-4.52***)	(-2.97***)	(-2.72***)	(-2.99***)
Thailand	-3.06***	-3.72***	-2.08***	-4.66***
	(-3.15***)	(-2.97***)	(-4.15***)	(-4.65***)
Latin America	-3.04***	-4.11***	-3.77***	-4.46***
	(-3.11***)	(-3.34***)	(-3.77***)	(-4.46***)
Argentina	-3.97***	-3.75***	-3.07***	**-2.46****
	(-2.01**)	(-3.41***)	(-3.09***)	(-4.51***)
Brazil	-5.44***	-4.37***	-3.51***	-4.53***
	(-3.86***)	(-3.22***)	(-3.51***)	(-4.54***)
Chile	-4.78***	-2.58**	-3.78***	**-2.16****
	(-5.04***)	(-3.52***)	(-3.79***)	**(-2.25**)**
Colombia	-4.40***	-4.05***	-3.47***	-3.84***
	(-5.89***)	(-3.58***)	(-3.47***)	(-4.03***)
Mexico	-3.61***	-3.43***	**-4.45*****	**-2.21****
	(-3.61***)	(-3.27***)	(-5.11***)	(-4.11***)
Peru	-3.95***	-4.14***	**-4.46*****	-4.28***
	(-3.95***)	(-3.43***)	**(-3.90***)**	(-4.29***)
Venezuela	-4.59***	-4.38***	-5.28***	-5.02***
	(-4.82***)	(-3.04***)	**(-3.83***)**	(-6.33***)

Area/Country	BoP Bond	EPFR Bond	BoP Equity	EPFR Equity
Emerging Europe	-3.49***	-3.91***	**-2.85*** **	**-3.01*** **
	(-3.49***)	(-3.00***)	**(-2.02**)**	**(-2.02**)**
Bulgaria	**-4.28*** **	**-2.47****	-1.99**	**-3.71****
	(-4.09*)**	**(-2.06**)**	**(-4.13***)**	(-4.56***)
Croatia	-7.11***	0.53	**-1.83***	**-4.75*** **
	(-6.93***)	(-4.29**)	**(-1.82*)**	**(-3.71***)**
Czech Republic	-4.66***	**-2.41****	**-1.99****	**-3.11*** **
	(-4.94***)	(-3.08***)	**(-3.64***)**	**(-2.57**)**
Hungary	**-2.47****	-1.64*	-1.97**	**-3.93*** **
	(-3.63***)	(-3.32***)	**(-2.25**)**	**(-3.22***)**
Kazakhstan	**-2.01****	-5.00***	**-5.40*** **	**-2.75****
	(-3.45***)	(-3.13***)	**(-2.13**)**	**(-2.12**)**
Lithuania	-5.15***	-0.63	**-2.81*** **	-4.06***
	(-3.80***)	(-4.12***)	**(-2.83***)**	**(-1.96**)**
Poland	-4.39***	-4.34***	-4.75***	**-2.50****
	(-4.46***)	(-2.99***)	(-4.77***)	**(-2.31**)**
Romania	-2.15**	-1.83*	-3.06***	-3.71***
	(-5.83***)	(-1.88*)	(-3.06***)	(-3.71***)
Russia	-3.16***	-3.53***	**-2.13****	**-2.88*** **
	(-3.16***)	(-2.75***)	**(-2.32**)**	**(-2.11**)**
Turkey	-3.70***	-4.09***	-5.40***	**-2.26****
	(-3.70***)	(-2.87***)	(-4.80***)	(-4.11***)
Ukraine	-5.25***	-3.25***	-3.63***	**-4.83*** **
	(-3.46***)	(-3.19***)	(-3.70***)	**(-2.73***)**
Other EMs	**-7.01*** **	-4.02***	**-2.52****	-4.14***
	(-4.02***)	(-3.79***)	(-4.38***)	(-4.15***)
Israel	**-2.03****	-6.04***	**-6.79*** **	**-4.03*** **
	(-2.83***)	(-2.52**)	**(-3.94***)**	**(-2.26**)**
Lebanon	-5.78***	**-3.84****	**-1.98****	**-2.86*** **
	(-4.57***)	(-2.61**)	**(-2.05**)**	**(-2.14**)**
South Africa	**-4.05****	-1.68*	**-2.20****	-4.49***
	(-6.21***)	(-3.91***)	(-3.45***)	(-4.49***)

Appendix 2.4: cointegration tests results (ADF and PP) for BoP and EPFR flows

Note: The table presents the ADF (PP) t-statistics on the estimated residuals $\hat{\varepsilon}_{it} = Y_{it} - \hat{\beta}_i X_{it} - [\hat{\alpha}_i]$ where i denotes the different countries and regional aggregates, t denotes time, $\hat{\varepsilon}$ is the estimated error term from OLS regressions of BoP gross portfolio capital flows, Y, on EPFR flows, X, $\hat{\beta}$ is the estimated cointegrating coefficient and $\hat{\alpha}$ is the estimated intercept (only if it is statistically significant). The figures in bold reflect the ADF (PP) t-statistics on the estimated residuals in level. According to the first step of the Engle and Granger (1987) procedure, we have to compare these t-statistics with the critical values on MacKinnon tables (MacKinnon, 1996). *, ** and *** denote rejecting the null hypothesis that there is a unit root at the 10%, 5% and 1% level of confidence, respectively. OLS denotes the fact that we estimate the OLS regression $Y_{it} = [\alpha_i] + \beta_i X_{it} + \varepsilon_{it}$. In this case, we don't need to test the stationarity of the estimated residuals. We see that more than 70% of the series are cointegrated, almost 15% are estimated in a simple OLS framework while about 15% are not considered because the variables are not integrated of the same order or because there is no cointegration relationship. At this point, it is interesting to note that the series which are not considered are mainly equity flows, more specifically toward small EMs. In fact, it is difficult to establish a cointegration relationship (or at least a simple linear relationship) when BoP flows are low and therefore EPFR flows (which are a sample of total flows) are even lower for the smaller EMs of the study.

Area/Country	$\hat{\varepsilon}_{it}^{Bond}$	$\hat{\varepsilon}_{it}^{Equity}$
All EMs	**-3.14*** (-1.94*)**	**-1.95* (-1.95*)**
Emerging Asia	**-5.10*** (-2.27**)**	**-2.49** (-1.72*)**
China	OLS	**-2.14** (-2.27**)**
India	**-1.99** (-1.99**)**	*-4.26*** (-2.06**)*
Indonesia	**-2.91*** (-2.81***)**	-2.71*** (**-2.66***)**
South Korea	**-4.69*** (-2.19**)**	**-2.98*** (-2.93***)**
Pakistan	*-6.39*** (-6.39***)*	**-4.86*** (-1.79*)**
Philippines	**-2.79*** (-1.84*)**	*-3.35*** (-3.47***)*
Thailand	**-2.16** (-2.31**)**	*-4.08*** (-4.15***)*
Latin America	**-4.67*** (-2.01**)**	-2.10** (**-1.93*)**
Argentina	-6.09*** (**-2.02**)**	*-4.43*** (-4.56***)*
Brazil	**-4.67*** (-1.87*)**	**-2.25** (-1.74*)**

Area/Country	$\hat{\varepsilon}_{it}^{Bond}$	$\hat{\varepsilon}_{it}^{Equity}$
Chile	*-3.69**** *(-5.36***)*	*-6.29**** *(-6.62***)*
Colombia	**-10.72***** **(-3.07***)**	**-3.96***** **(-1.72*)**
Mexico	**-4.90***** **(-1.93*)**	**-1.86*** **(-2.35**)**
Peru	**-2.32**** **(-2.37**)**	***-4.87****** ***(-3.72***)***
Venezuela	**-2.19**** **(-2.35**)**	-5.28*** **(-3.83***)**
Emerging Europe	**-2.45**** **(-2.61**)**	OLS
Bulgaria	OLS	**-2.96***** **(-2.97***)**
Croatia	**-3.10***** **(-3.28***)**	OLS
Czech Republic	-4.90*** **(-2.20**)**	OLS
Hungary	**-2.85***** **(-1.86*)**	OLS
Kazakhstan	*-3.66**** *(-3.61***)*	OLS
Lithuania	*-5.39**** *(-3.38***)*	OLS
Poland	**-2.52**** **(-2.11**)**	*-5.22**** *(-5.23***)*
Romania	**-2.06**** **(-3.06***)**	**-2.94***** (-3.30***)
Russia	**-3.42***** **(-2.47**)**	OLS
Turkey	**-3.80***** **(-2.53**)**	**-2.07**** **(-2.33**)**
Ukraine	*-5.04**** *(-4.39***)*	***-4.05****** ***(-2.15**)***
Other EMs	**-3.06***** **(-2.09**)**	-4.68*** (-4.68***)
Israel	**-2.02**** **(-1.86*)**	OLS
Lebanon	**-1.71*** **(-1.99**)**	OLS
South Africa	**-2.10**** **(-3.11***)**	**-5.01***** (-5.11***)

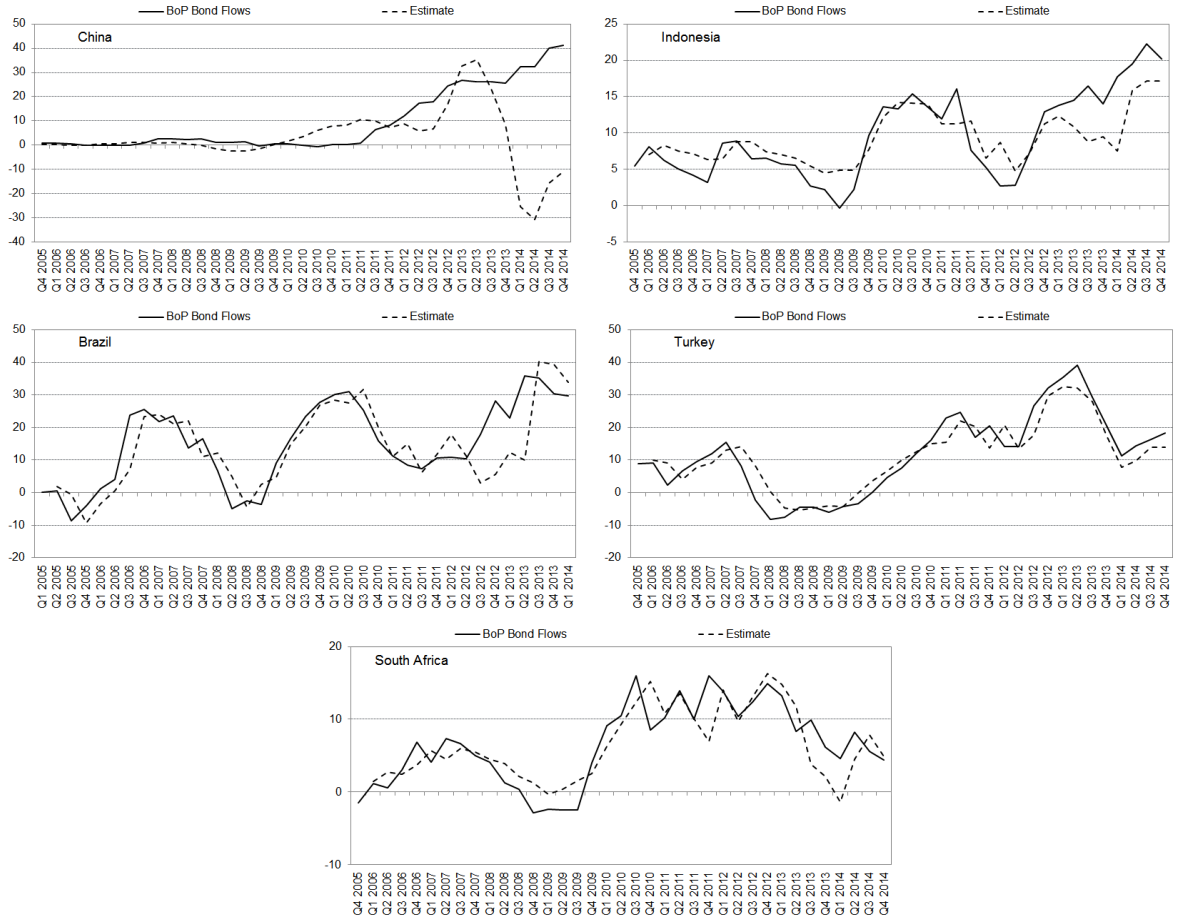
Appendix 2.5: estimates for large EMs (USD billion, four-quarter moving sum)

Note: The table presents the results of the ECM $\Delta Y_{it} = \gamma_i \Delta X_{it} + \delta_i \hat{\varepsilon}_{it-1} + \nu_{it}$ and the coefficient β of the OLS $Y_{it} = [\alpha_i] + \beta_i X_{it} + \varepsilon_{it}$. Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively. We want to emphasise that δ should be significantly negative. Otherwise, the ECM regression is not valid. Moreover, δ measures the speed at which prior deviations from equilibrium are corrected. Finally, if $X \rightsquigarrow I(d_1)$ and $Y \rightsquigarrow I(d_2)$ (with $d_1 \neq d_2$ and $d_j \in \mathbb{Z}^+$ for $j = \{1, 2\}$), then we do not estimate any model to avoid spurious regression because the variables which are integrated of a different order cannot be cointegrated.

Dependent Variable: *D(BoP Bond)*
Q1 2006 - Q4 2014

Variable	China	Indonesia	Brazil	Turkey	South Africa
γ_i		1.725***	2.548***	3.564***	3.209***
		(.522)	*(.808)*	*(1.072)*	*(1.072)*
δ_i		-0.412**	-0.282**	-0.273**	-0.486***
		(.187)	*(.133)*	*(.124)*	*(.169)*
Long-term relationship					
β_i	10.920***	1.814***	1.976***	7.220***	2.384***
	(.891)	*(.267)*	*(.567)*	*(.804)*	*(.500)*
Number of Observations	37	36	36	36	36
Adj. R-Squared	0.76	0.36	0.37	0.31	0.26

Note: The figures plot the four-quarter moving sum of BoP portfolio bond flows (continuous line) and the EPFR coincident indicator for bond flows (dashed line). Each figure reflects a different country. According to the IMF terminology (2011a), we identify three global waves of capital inflows in the time interval we consider in this chapter: Q4 2006 to Q2 2008, Q3 2009 to Q4 2010 and Q1 2012 to Q1 2013.

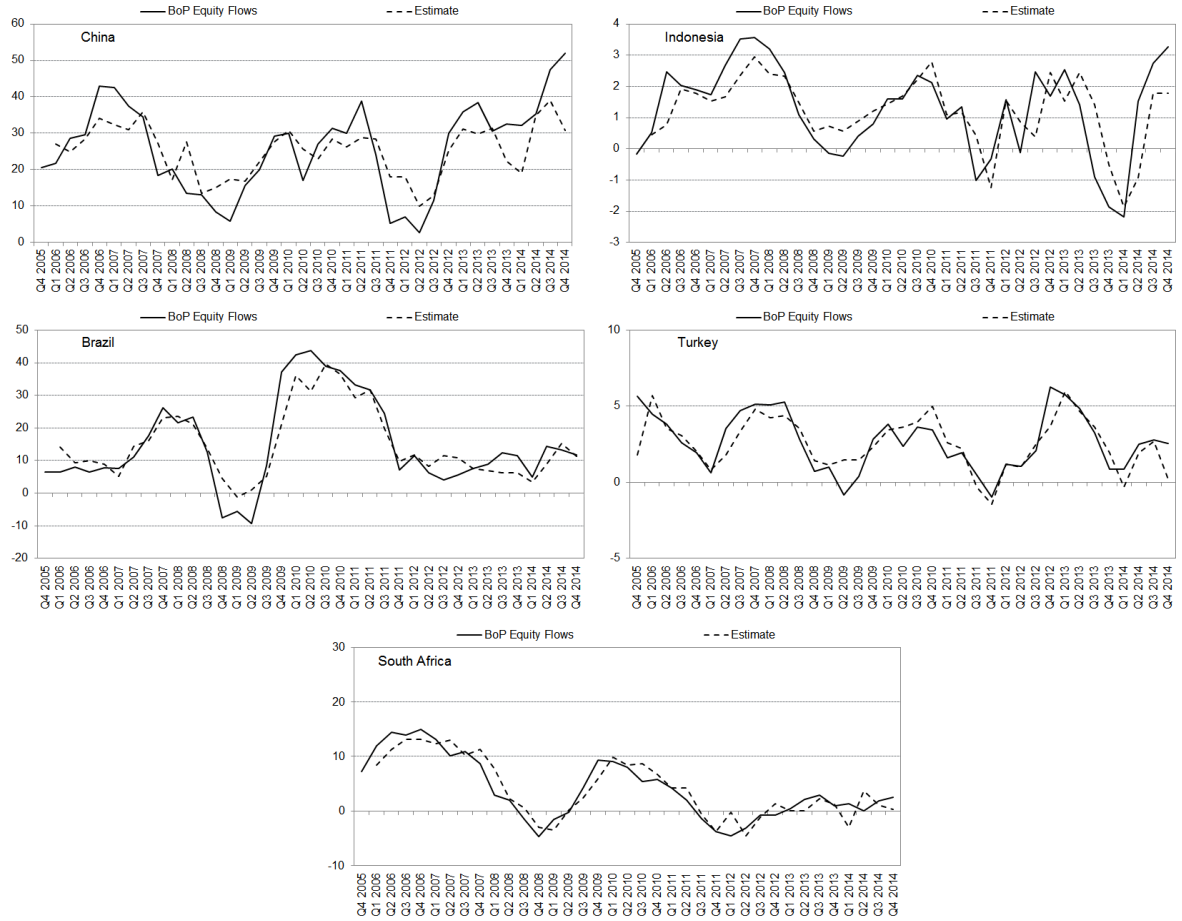


Note: The table presents the results of the ECM $\Delta Y_{it} = \gamma_i \Delta X_{it} + \delta_i \hat{\varepsilon}_{it-1} + \nu_{it}$ if any and the coefficient β of the OLS $Y_{it} = [\alpha_i] + \beta_i X_{it} + \varepsilon_{it}$. Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively. For the simple OLS regression, estimates are made between Q4 2005 and Q4 2012. We want to emphasise that δ should be significantly negative. Otherwise, the ECM regression is not valid. Moreover, δ measures the speed at which prior deviations from equilibrium are corrected. Finally, if $X \rightsquigarrow I(d_1)$ and $Y \rightsquigarrow I(d_2)$ (with $d_1 \neq d_2$ and $d_j \in \mathbb{Z}^+$ for $j = \{1, 2\}$), then we do not estimate any model to avoid spurious regression because the variables which are integrated of a different order cannot be cointegrated.

Dependent Variable: *D(BoP Equity)*
Q1 2006 - Q4 2014

Variable	China	Indonesia	Brazil	Turkey	South Africa
γ_i	0.625***	0.686***	1.026***	1.500***	1.477***
	(.167)	*(.214)*	*(.200)*	*(.243)*	*(.408)*
δ_i	-0.351**	-0.354**	-0.292***	-0.240**	-0.075
	(.138)	*(.151)*	*(.106)*	*(.106)*	*(.065)*
Long-term relationship					
β_i	0.863***	0.362*	1.556***	0.879***	2.019***
	(.182)	*(.206)*	*(.269)*	*(.282)*	*(.508)*
Number of Observations	36	36	36	36	36
Adj. R-Squared	0.51	0.35	0.59	0.60	0.30

Note: The figures plot the four-quarter moving sum of BoP portfolio equity flows (continuous line) and the EPFR coincident indicator for equity flows (dashed line). Each figure reflects a different country. According to the IMF terminology (2011a), we identify three global waves of capital inflows in the time interval we consider in this chapter: Q4 2006 to Q2 2008, Q3 2009 to Q4 2010 and Q1 2012 to Q1 2013.



Appendix 2.6: weekly and monthly EPFR country flows are quite comparable

Note: The table presents the results of the OLS $Y_{it} = \beta_i X_{it} + \varepsilon_{it}$. Standard errors are in parentheses. *, ** and *** denote statistical significance at the 10%, 5% and 1% level of confidence, respectively. As we can see, weekly and monthly EPFR country flows are quite comparable. Indeed, *Adj. R-Squared* oscillates around 0.90 and the scale factor (represented by the coefficient β which is always significantly positive) is fairly stable for both bond flows and equity flows. β varies between 1.4 and 1.6 for bond blows while it varies between 1.1 and 1.2 for equity flows.

Dependent Variable: *EPFR Bond* or *EPFR Equity*
M1 2005 - M9 2013 (105 observations)

Variable **Area/Country**	β_i^{Bond}	*Adj. R-Squared*	β_i^{Equity}	*Adj. R-Squared*
All EMs	1.538*** *(.035)*	0.93	1.181*** *(.033)*	0.92
Emerging Asia	1.517*** *(.033)*	0.94	1.141*** *(.035)*	0.90
China	1.365*** *(.021)*	0.96	1.116*** *(.026)*	0.94
Indonesia	1.461*** *(.031)*	0.94	1.177*** *(.039)*	0.89
Latin America	1.501*** *(.038)*	0.92	1.192*** *(.033)*	0.92
Brazil	1.480*** *(.03)*	0.92	1.182*** *(.032)*	0.92
Emerging Europe	1.540*** *(.042)*	0.91	1.191*** *(.035)*	0.92
Turkey	1.404*** *(.040)*	0.91	1.109*** *(.030)*	0.93
Other EMs	1.589*** *(.043)*	0.91	1.127*** *(.044)*	0.84
South Africa	1.594*** *(.046)*	0.90	1.104*** *(.038)*	0.87

Chapitre 3 Testing for Multiple Bubbles in Emerging Equity Markets in the "New Normal"

Résumé non technique

Dans le **troisième chapitre**, nous partons du constat que, depuis la crise financière mondiale de 2007-08 et la « Grande Récession » qui a suivi, les principales banques centrales des MD ont entrepris des politiques monétaires non conventionnelles, poussant les taux d'intérêt réels vers des niveaux historiquement bas. Dans ce contexte de « Nouvelle Normale », l'intensification de la recherche de rendement de la part des investisseurs internationaux a pu nourrir une certaine forme d'exubérance sur les ME, notamment sur leurs marchés d'actions. Dans ce troisième et dernier chapitre, nous nous demandons si la faiblesse historique des taux d'intérêt réels et la recherche de rendement induite ont pu conduire à des bulles sur les marchés d'actions émergents ou plus simplement à des effets de réallocation des portefeuilles. La détection de bulles sur les marchés immobilier ou d'actions a fait l'objet de nombreuses études (Shiller, 1981 ; LeRoy et Porter, 1981 ; Blanchard et Watson, 1982 ; West, 1987 ; Campbell et Shiller, 1987 ; Diba et Grossman, 1988 ; Hamilton, 1989 Kim *et al.*, 2002 ; Homm et Breitung, 2010 ; Phillips *et al.*, 2011 ; Phillips et Yu, 2011). Afin d'identifier et de dater précisément les périodes d'exubérance, voire d'effondrement, des marchés d'actions émergents, nous utilisons une procédure statistique de datation des bulles appelée séquence *Backward Sup ADF* (Phillips *et al.*, 2013a et 2013b). Hormis en Chine, où une bulle domestique a éclaté pendant l'été 2015, nous avançons des preuves solides en faveur d'effets de réallocation des portefeuilles dans l'ère post-Lehman. Ces effets ont généré de fortes pressions haussières sur les prix des actions émergentes, conduisant à des excès de valorisation, mais pas assez pour parler de bulles, tout du moins à la fin de l'année 2015.

3.1 Introduction

Since the global financial crisis of 2007-08 and the great recession that followed, the central banks of the main Developed Markets (DMs) have considerably eased their monetary policies by lowering interest rates and through succesive rounds of Quantitative Easing (QE). More recently, the People's Bank of China (PBoC) joined its developed counterparts in boosting liquidity to address weakening growth, promote credit expansion and recapitalise its equity markets. The very accommodative and unconventional monetary policies undertaken by the major central banks in recent years have exacerbated the downward pressure on interest rates and have led to very rapid and strong growth of global liquidity. In this "New Normal" environment, global excess liquidity has led investors to search for yield by turning towards higher-return, and therefore riskier, assets as argued by the IMF (2010b) and Matsumoto (2011). In this new world of historically low real interest rates, it makes sense to assume that Emerging Markets (EMs) represent one of the best investment opportunities for DM investors.

In the post-Lehman era, asset price inflation was initially well received both by investors and policymakers. In particular, the rebound in equity markets, which began in the United States in 2009 and which was followed soon after everywhere and for other asset classes, was first seen as a normalisation process for deeply undervalued assets. However, the low real interest rates and structural economic features indicate that this is consistent with the "New Normal". In other words, there is no "bond bubble" but we can ask ourselves if there are some equity bubbles, especially in EMs. Indeed, since late November 2008 and the launch of the first QE by the Federal Reserve, the EMs have seen some surges in capital flows (Fratzscher *et al.*, 2012), which have notably boosted the emerging equity markets. The potential excess valuation of these emerging equity markets could lead to rational bubbles or simply to some portfolio rebalancing effects.

In this chapter, we explore how best to detect rational bubble periods in emerging equity markets in this "New Normal" environment. Most studies have used present value models and focused on statistical and econometric tests which are sensitive to model specifications, *e.g.*, to mention a few, Shiller (1981) and LeRoy and Porter (1981) for the variance bound test; Blanchard and Watson (1982) for probability distribution; West (1987) for the two-step test; Campbell and Shiller (1987) and Diba and Grossman (1988) for the cointegration test; Hamilton (1989) for the regime switching test; Kim *et al.* (2002) and Homm and Breitung (2010) for the structural break test. More recently,

Phillips *et al.* (2011) and Phillips and Yu (2011) propose the recursive right-tailed ADF test using an expanded subsample, *i.e.*, the Sup ADF test (SADF). However, although this test offers real time monitoring of bubble periods, it does not allow for periodically collapsing bubbles. Therefore, Phillips *et al.* (2013a and 2013b) propose to better identify multiple episodes of exuberance and collapse in long time series. For that purpose, they implement a generalised version of the SADF test which allows the sample sequence to be extended to a broader and more flexible range than for the SADF test. When formulating the Generalised Sup ADF (GSADF) test, the authors also proposed a new approach to date stamp the origination and termination of bubbles, *i.e.*, the Backward Sup ADF (BSADF) sequence.

Our first and main contribution is to analyse the link between the investors' search for yield in this new environment of very low real interest rates and the excess valuation of emerging equity markets in order to detect potential rational bubbles in these markets. Overall, according to the results of the BSADF sequence proposed by Phillips *et al.* (2013a and 2013b) to date-stamp the bubble periods, we find that the search for yield did not result in emerging equity market bubbles. Indeed, apart from China, since late November 2008 and the launch of the first round of the Federal Reserve QE, the emerging equity markets experienced fewer exuberant periods than before. Consequently, we find strong evidence for portfolio rebalancing effects towards emerging equity markets. These portfolio rebalancing effects have generated significant upward pressures on emerging equity markets but they have not yet created rational bubbles. Our second contribution is to provide a detailed study of the 2015 Chinese domestic bubble bursting. According to the date-stamping strategy used in this chapter, the bubble period starts in December 2014, intensifies in April and May 2015, bursts in June 2015 and ends at the end of July 2015.

The chapter is organised as follows: As background, Section 3.2 focuses on the economic and financial framework and the empirical litterature on bubble testing. Section 3.3 introduces the data and the methodology we use to detect potential bubble periods. We also presents some brief results on the S&P 500 index. Section 3.4 presents our main findings, interprets them, and is completed by a more thorough study on the 2015 Chinese bubble bursting. We conclude our study in Section 3.5.

3.2 Economic and theoretical framework

The global financial crisis of 2007-08 and the great recession that has followed has completely changed the global macroeconomic and financial landscape. Interest rates have fallen and structural economic features tend to indicate that it is the natural rate of interest rate (sometimes qualified as the "equilibrium interest rate", or the "Wicksellian" interest rate) that has fallen. In very simple terms, the natural interest rate is the real interest rate that is consistent with full employment and full capacity use.

Low long-term interest rates are not aberrant but part of a long-term downward trend which can only be partially explained by the fall in inflation over the past 30 years. This economic diagnosis is of utmost importance as it means that the historically low level of nominal interest rates is not the sign of a "bond bubble" driven by monetary policy or regulation but the sign of something unusual and that we can design as the "New Normal".

Financial bubbles refer to asset prices that exceed their fundamental value as determined by the discounted expected value of the cash flows that the asset generates (Blanchard and Watson (1982); Diba and Grossman (1987 and 1988)). Bubbles are growing because current owners believe that they can resell the asset at an even higher price in the future. There are different kinds of bubbles but even though it is commonly agreed that irrationality exists in financial markets and that bubbles contain irrational elements, we focus here on rational bubbles on equity markets because these are the most covered in the literature and are easier to test.

3.2.1 Economic framework

Both real and nominal government bond yields have been declining since the early 1980s, with nominal rates falling to near record lows all around the world. The world interest rate, *i.e.*, calculated as a weighted average, has continuously declined since the mid-1980s, from around 5% in the early 1980s to 2% on average between 2000 and 2011. We also note that the dispersion between national real interest rates has also diminished over time (Blanchard *et al.*, 2014); this lower dispersion supports the notion of a global interest rate which is determined in a global market. Even with substantial heterogeneity, a downward trend in real interest rates is also visible in EMs (Rachel and Smith, 2015).

Importantly, while the global interest rate can be affected by monetary policies in the short run, it is not determined by monetary factors in the long run but by the state of the economy. More precisely, this global real rate is determined by (i) global savings, (ii) global investment and (iii) the "relative demand for safe *vs.* risky assets[66]".

In a nutshell, the post-Lehman era is characterised by many stylised facts, among which:

Unconventional monetary policies:

- Central banks have embarked on large-scale asset-purchases to avoid a debt-deflation spiral. There are several channels through which QE policies can have an impact on asset prices, *e.g.*, signalling effect, change in the relative supply of the assets being purchased, lower liquidity premiums, etc. The compression of interest rates creates incentives for investors to rebalance their portfolios away from sovereign bond markets. QE policies thus artificially inflate asset prices by lowering expectations about the path of future short-term interest rates.
- QE policies were intended to boost both GDP growth and inflation through multiple channels, *e.g.*, low real interest rates, wealth effects, incentives for banks to diversify their portfolios and to distribute more credit. But so far, inflation on goods and prices has failed to restart. Inflation does however materialise on asset prices from sovereign and corporate bonds, to equities and, to some extent, real estate.
- Despite historically accommodative monetary policies and some strong commitments to maintain a high level of accommodation, the economic recovery has remained sluggish by historical standards and inflation rates have not returned to central banks' targets.

[66] As noted by Blanchard *et al.* (2014), the shift in investors' preference towards safe assets can be due to financial regulation. In fact, since the great financial crisis, the demand (for) and supply of government bonds have been particularly affected by (i) a sustained increase of government bonds holdings by commercial banks due to stricter regulation (Basel III) and (ii) by central bank QEs. Indeed, QEs provide a safety net that has probably encouraged banks to increase their holdings of government bonds. At the end of the day, it is difficult to disentangle the impact of financial regulation from the impact of QEs. In the Eurozone for instance, both have probably led banks to increase their exposure to the sovereign bond market. Take the example of the fall in the 10-year German government bond yield which declined from around 2% to 0.5% in 2014, and fell to an historical low of 0.1% in April 2015. This move was driven by the expectation of upcoming purchases from the ECB, not by the state of the economy. Even if regulation and QEs have played a role, these variables cannot explain the downward trend that started before the great financial crisis.

A slowdown in potential growth:

- Potential growth is slowing not only in the major advanced economies but also in most EMs. World potential growth is trending lower notably because of an aging population, the fall in total-factor productivity, the debt overhang and insufficient fiscal stimulus (Lo and Rogoff, 2015). Private investment has remained sluggish in most economies, hardly sufficient to replace obsolete equipment. Subsequently, looking ahead, the probability of big innovations is low. This could mean that productivity will not return to its upward trend and that the slowdown in potential growth is a structural and durable phenomenon, feeding the secular stagnation thesis[67].

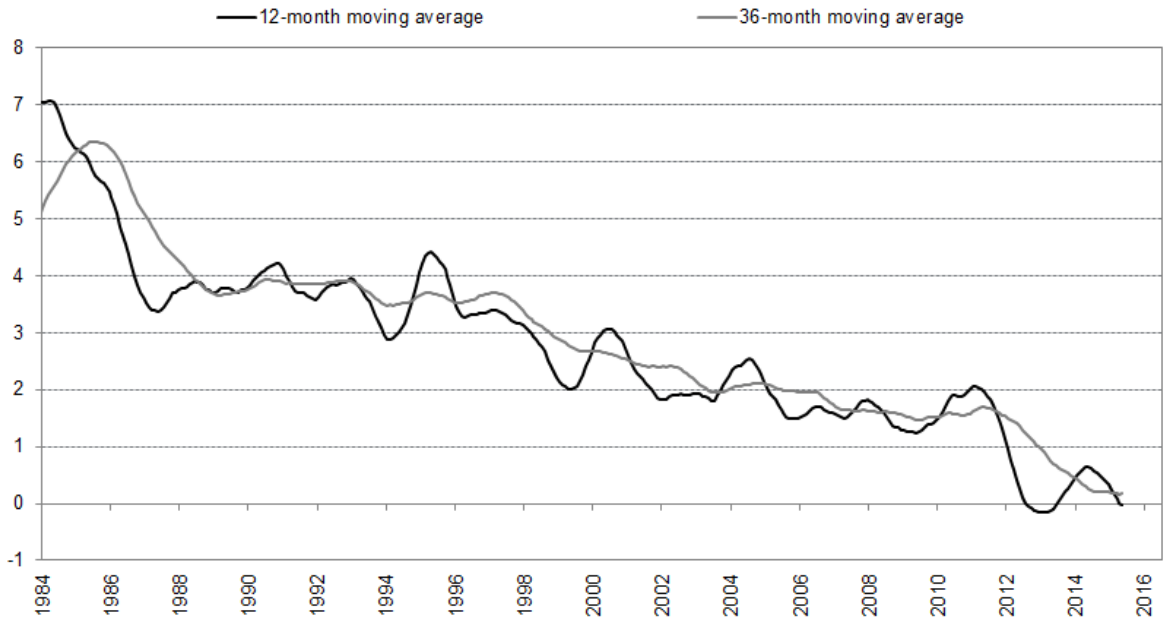
The global deleveraging has hardly started:

- Global debt, *i.e.*, corporates, households and sovereigns, has continued to increase in most economies. Looking ahead, the slow nominal growth and high debt environment will exacerbate the difficulties encountered by economic agents to deleverage.
- Against this backdrop, any external shock, including a substantial rise in long-term bond yields, could precipitate the global economy in a deflationary trap. Risks to inflation are thus asymmetric and most central banks are trapped into QE policies. This is an environment of financial repression, where central banks must maintain, possibly artificially, low nominal and real interest rates, and where their asset purchases may have become a conventional tool of monetary policy.
- The fact is that real interest rates have dramatically fallen over the past 30 years, *cf.* Figure 7. The natural real interest rate had started to diminish prior the global financial crisis. Some recent research papers find that the natural real interest rate has continued to drop. In other words, low interest rates are not the byproduct of QE policies and tighter regulation but reflect the world's "New Normal".

[67] The global phenomenon of excess savings is lending credence to the theory of "secular stagnation". Despite highly accommodative financial conditions and abundant cash, business investment has remained very sluggish by historical standards – hardly enough in most DMs to renew the capital stock. The reason for this is excess global savings, a phenomenon that is pushing down the natural interest rate in some cases into negative territory. Because of weak inflation, real interest rates are not declining enough, and the global economy is trapped in an under-employment equilibrium, which is squeezing potential growth and inflation expectations. While it has not been borne out by the facts, the "secular stagnation" hypothesis is gaining currency and could become a self-fulfilling prophecy, *i.e.*, weak expected demand discourages productive investment, expands excess savings and pushes down on real interest rates. Monetary policy becomes progressively ineffective (the liquidity trap) and there are increasing calls to add fiscal policy to it (when that is possible), to boost global demand. However, national governments are running into debt constraints that limit their room for manoeuvre.

Figure 7: 10-year real interest rate: weighted average of G7 countries

Note: As in King and Low (2014), the figure shows the weighted average of the 10-year real interest rate for the G7 countries, *i.e.*, the United States, Canada, the United Kingdom, Japan, Germany, France and Italy. We use the relative PPP GDP weights of each countries to build the weighted average of the G7 10-year nominal interest rate. Then, we remove the core CPI of the United States to get a proxy of the G7 10-year real interest rate. We find, with a different calculation, the same downward trend as King and Low (2014). Finally, we compute the 12- and 36-month moving averages in order to reflect the downward trend of the G7 10-year real interest rate which has been occuring over the past 30 years.



There is a co-movement between the global nominal interest rate and the world nominal GDP growth (the same is true in real terms), which is in line with a simple golden rule approach[68].

Asset price inflation was initially well received both by investors and policymakers. In particular, the rebound in equity markets, which began in the United States in 2009, was first seen as a normalisation process for deeply undervalued assets. The same holds true for corporate bonds. But there comes a time when equity markets return to their equilibrium levels.

On the one hand, in a new world of historically low real interest rates, the search for yield is exacerbated by QE policies. *Ceteris paribus*, the fall in the natural equilibrium real interest rate probably increases the equilibrium level of equities, *i.e.*, higher equilibrium price-to-earnings ratios. But, on the other hand, it should be noted that, in the long run, profit growth cannot exceed potential GDP growth. Subsequently, the "New Normal" should also mean that the average return on equity markets is likely to decline over time.

The new macroeconomic and financial regime is highly unstable with monetary policies that will probably generate, at some point, excessive inflation on asset prices. While it is rational for investors to rebalance their portfolios towards risky assets, there will come a time when they should stop this process. In such a context, there is no easy way to detect *ex ante* when a bubble becomes irrational. In this chapter, we focus on the available tools for early detection of equity bubbles[69].

3.2.2 Theoretical framework

We start with the most commonly used present value model in which P_t denotes the current asset price at time t before the dividend payout, D_t is the dividend payoff of this same asset, and r is the discount rate with $r > 0$. We assume an informational efficient market with rational agents wherein a no-arbitrage condition implies that asset prices can be written as follows:

$$P_t = (1+r)^{-1} \mathbb{E}_t \left[P_{t+1} + D_{t+1} \right] \tag{13}$$

[68] The 5-year moving average of the world nominal GDP growth move in tandem with nominal long-term interest rates.
[69] While we acknowledge that we could be in presence of other bubbles, especially in the corporate bond market, the bulk of the literature tends to focus on equity markets.

If we solve this equation recursively, we have:

$$P_t = F_t + B_t \tag{14}$$

where $F_t = \sum_{j=1}^{\infty} (1+r)^{-j} \mathbb{E}_t [D_{t+j}]$ and:

$$\mathbb{E}_t [B_{t+1}] = (1+r) B_t \tag{15}$$

From equation (13), we see that the asset price is broken down into two components, a fundamental component F_t, which is determined by expected discounted future dividends, and a bubble component B_t. In the absence of bubbles, $B_t = 0$ and $P_t = F_t$. In order for the solution to be valid in the presence of bubbles, B_t must satisfy the submartingale property in equation (14) and hence, P_t will encompass the explosive behaviour inherent in B_t.

Over long periods, some asset prices like equities may contain a drift component and in practice, this drift component is usually small and tends to be negligible over shorter periods. Therefore, both B_t and P_t increase quickly during the boom phase of the bubble in accordance with $\mathbb{E}_t [B_{t+h}] = (1+r)^h B_t$ and $B_0 > 0$. Then, when the bubble bursts, $P_t = F_t$ and the asset price suddenly collapses. We assume that the dividend process D_t follows a martingale, reflecting cash flow generation, thus F_t is similarly a martingale and is cointegrated with D_t. In this background, the presence of a bubble submartingale component B_t can lead to mildly explosive behaviour in the asset price P_t.

An important characteristic of this model is that the discount rate r_t may be time varying and the time path of r_t can have some significant effects on both fundamental and bubble components. Given that the time varying discount rate r_t might be either stationary in level or in first differences, it does not change our theoretical framework in so far as the equation (14) becomes:

$$\mathbb{E}_t [B_{t+1}] = (1+r_t) B_t \tag{16}$$

Then, if equation (14) is satisfied, then $r = \left(\prod_{t=1}^{T} (1+r_t) \right)^{1/T} > 1$ and implies explosive behaviour of B_t and hence P_t, even though F_t is not explosive[70]. Consequently, a realistic model might allow for uncertainty in a particular time path with a stochastic

[70] For more details on the effects of a time varying discount rate on the characteristics of both fundamental and bubble components, *cf.* Phillips and Yu (2011).

trajectory for r_t that accommodated potential upwards shifts in the discount factor which, *in fine*, increase the present value of the asset. To tackle this issue, we must use some econometric date-stamping procedures to assess evidence for periods of explosive price behaviour, whether in the case of time varying discount rates or for other potential sources of financial exuberance.

3.2.3 Bubble detection: review of empirical tests

In the econometric literature, detecting a bubble in real time has proven to be a huge challenge. Indeed, most econometric techniques are sensitive to the choice of fundamental value estimations and/or model specifications. Moreover, these techniques also suffered from finite sample bias.

Table 15 provides a review of empirical tests for asset price bubble detection. First, some of these tests directly compare equity prices with fundamentals and, as stated above, the effectiveness of these tests largely depends on the model specification. Second, taking the example of conventional unit root and cointegration tests, it is easy to show that these tests are able to detect only one-off explosive price behaviour and thus are unlikely to detect multiple collapsing bubbles. In other words, conventional unit root tests are not well specified to handle changes in the time series degree of non stationarity. Consequently, the standard cointegration tests fail to detect truthful cointegration relationships on different subperiods. Moreover, Gürkaynak (2008) argued that detection of asset price bubbles can not be achieved with a satisfactory degree of certainty. Indeed, for almost each paper that finds evidence of bubbles, there is another one that fits the data equally well without allowing for a bubble.

More recently and in the line of previous works on SADF tests pioneered by Phillips *et al.* (2011), Phillips *et al.* (2013a and 2013b) propose to better identify multiple episodes of exuberance and collapse in long time series. For that purpose, they implement a generalised version of the SADF test which allows to extend the sample sequence to a broader and more flexible range than for the SADF test. When formulating the GSADF test, the authors also proposed a new approach to date stamp the origination and termination of bubbles, *i.e.*, the Backward Sup ADF (BSADF) sequence. Moreover, simulations show that the test significantly improves discriminatory power and leads to distinct power gains when multiple bubbles occur. Therefore, the GSADF test outperforms all the other tests in terms of power, detection rate and accuracy of the

Table 15: Chronological review of empirical tests on bubbles detection

Note: The table provides an exhaustive review of empirical tests for asset price bubble detection. We classified these tests chronologically.

Test type	Test description	References	Test limitations
Hurst persistence test	Long-term dependence, *i.e.*, memory, in the equity market volatility.	Mandelbrot (1972) Rejichi and Aloui (2012)	Estimation of the fundamental value with a VAR model can lead to detect substancial volatility instead of bubble.
Variance bound test	Rational price does not fluctuate in line with the observed price due to forecast errors in expected dividends.	Shiller (1981) LeRoy and Porter (1981) Kleidon (1986) Cochrane (1992)	Linearity in changes of prices and dividends. Dividends and equity prices must be stationary. Expected return must be constant over time.
Probability distribution	Equity returns are negatively skewed and exhibit fat tails.	Blanchard and Watson (1982) Lux and Sornette (2002)	Could also explain some changes in the fundamental value.
Structural break test	Regime shifts from a random walk to an explosive process in the price series.	Bhargava (1986) Kim (2000) Kim *et al.* (2002) Onour (2009) Homm and Breitung (2010) Breitung and Kruse (2013)	Assume a single structural break. Lack of power if there are multiple structural breaks.
Two-step test	First, regression of p_t on $p_{t+1} + d_{t+1}$with d_t as an instrument (without a bubble). Second, dividends follow a stationary $AR(n)$ process (with a bubble)	West (1987) Dezhbakhsh and Demirguc-Kunt (1990)	Linearity in changes of prices and dividends. Long series of observations are required. Problem in implementation.
Cointegration test	Dividends and prices should be cointegrated stationary processes in the null hypothesis of no bubbles.	Campbell and Shiller (1987) Diba and Grossman (1988) Nasseh and Strauss (2004)	Stationarity of dividends is required. Long series of observations are required. Does not allow for periodically collapsing bubbles. Inconclusive possible results.
Regime switching test	Switching regimes depends on the relative size of the bubble and of the abnormal returns or trading volumes.	Hamilton (1989) Van Norden (1996) Hall *et al.* (1999)	Precision in measurements of fundamental value is required.
Duration dependance test	Bubbles imply negative duration dependence when abnormal returns are positive.	McQueen and Thorley (1994) Harman and Zuehlke (2004)	Sensitive to model specifications used to generate the abnormal returns.
Kalman filter	Bubble is an unobserved state vector in the state-space model estimated.	Wu (1997)	Negative values for bubble, which is theoretically impossible.
Sup ADF test	Recursive right-tailed ADF tests using expanded subsample. Real time monitoring.	Phillips *et al.* (2011) Phillips and Yu (2011)	Fixed starting point. Does not allow for periodically collapsing bubbles.

origination date. We will take a closer look at the GSADF test in the next section.

3.3 Data and Methodology

Conceptually, we have seen that global excess liquidity due to structurally lower real interest rates in DMs has fueled investors' search for yield and has led to some portfolio rebalancing effects. We wonder to what extent these portfolio rebalancing effects have impacted the emerging equity markets and if they have created some bubbles. To investigate this, we focus on EM equity indices, *i.e.*, MSCI indices and domestic indices, and especially on three different valuation ratios, *i.e.*, the price-to-dividend ratio, the price-to-book ratio and the price-to-earnings ratio. Then, we apply the GSADF test to detect these potential bubbles on these three different valuation ratios. This test is one of the most recent methodologies and has been proposed by Phillips *et al.* (2013a and 2013b). Finally, to prove the effectiveness of this test, we illustrate how it is running through the US equity market's flagship index, *i.e.*, the S&P 500 index.

3.3.1 Data

We gather monthly data for 21 EMs[71] from Bloomberg and Datastream databases. Since our data does not start on the same dates and in order to remain as exhaustive as possible, all our data samples for valuation ratios of MSCI indices end in May 2015 but start between January 1992 and August 1997. For valuation ratios of domestic equity indices, the existing data samples also end in May 2015 but start later, between March 1994 and January 2004[72]. However, in the remainder of this chapter, we are particularly interested in the 10 largest EMs capitalisations recorded in the MSCI indices in May 2015, *i.e.*, China, South Korea, Taiwan, Brazil, South Africa, India, Mexico, Russia, Malaysia and Indonesia.

3.3.1.1 Market data

Here, we define the two kinds of equity indices we use in this chapter, *i.e.*, the MSCI indices and the domestic equity indices. These two types of equity indices are collected in local currencies to avoid taking into account some potential currency effects.

[71] In descending order of capitalisation recorded in the MSCI indices in May 2015: China, South Korea, Taiwan, Brazil, South Africa, India, Mexico, Russia, Malaysia, Indonesia, Thailand, Poland, Turkey, Chile, Philippines, Colombia, Peru, Greece, Hungary, Egypt and Czech Republic.

[72] For some small EMs, some time series are discontinuous and have thus been linearly interpolated over periods ranging from one to five months to ensure the continuity of these time series.

1. **MSCI indices:** The Morgan Stanley Capital International are the indices most regularly followed by market participants. They are a free float-adjusted market capitalisation weighted index that is designed to measure the equity market performance of the market to which they refer. As of March 2015, there are more than 160,000 consistent and comparable indices which are used by investors around the world to develop and benchmark their global equity portfolios. On a worldwide basis, more than USD 9.5 trillion in assets are estimated to be benchmarked to these indices.

2. **Domestic equity indices:** The domestic or national equity index represents the performance of the stock market of a given country, and by proxy, reflects investor sentiment on the state of its economy. The most regularly quoted market indices are domestic indices composed of the stocks of large companies listed on a nation's stock exchanges. More formally, a domestic equity index is computed from the prices of selected stocks, typically with a weighted average. In this chapter, we gather the data of 18 domestic equity indices[73].

3.3.1.2 The different valuation ratios

Here, we define the three most used valuation ratios on equity markets, *i.e.*, the price-to-dividend ratio (P/D ratio), the price-to-book ratio (P/B ratio) and the price-to-earnings ratio (P/E ratio).

1. **Price-to-dividend ratio:** The P/D ratio is defined as the ratio of the total market value for the constituents of an index, expressed as a percentage of the total dividend amount of that index. This ratio is used as a measure of a company's/index's potential as an investment. It is equivalent to the inverse of the dividend yield.

2. **Price-to-book ratio:** The P/B ratio is defined as the ratio of the total market value for the constituents of an index, expressed as a percentage of its own book value, that is the total asset value of the constituents of that index less the value of their liabilities. The P/B ratio is used as a measure of investor sentiment on the

[73] China: Shanghai Composite and Shenzhen Composite; South Korea: KOSPI Composite; Taiwan: TWSE; Brazil: Bovespa; South Africa: FTSE/JSE 40; India: BSE Sensex; Mexico: IPC; Russia: MICEX; Malaysia: KLCI; Indonesia: IDX; Thailand: SET; Poland: WIG; Turkey: BIST 100; Philippines: PSEi; Greece: ATHEX; Hungary: BSE; Egypt: EGX 30.

value of a stock/index to its actual value according to the generally accepted accounting principles. A high P/B ratio means either that investors have overvalued the company/index, or that its accountants have undervalued it.

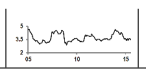
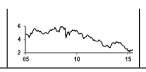
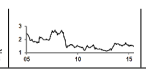
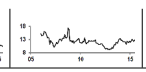
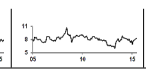
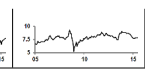
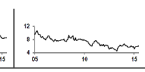
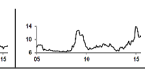
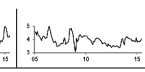
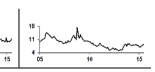
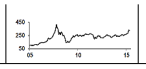
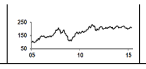
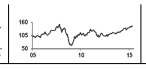
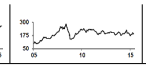
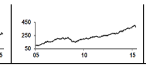
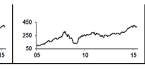
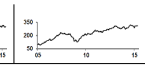
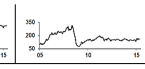
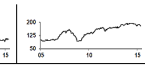
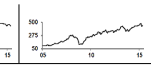
3. **Price-to-earnings ratio:** The P/E ratio is defined as the ratio of the total market value for the constituents of an index, expressed as the total earnings of that index. The P/E ratio is used as a meausre of investor sentiment. One of the important influences on the P/E ratio is long-term interest rates. Indeed, relatively high interest rates result in low P/E ratios, whereas low interest rates result in high P/E ratios. Although it would have been better to use cyclically adjusted P/E ratios, or Shiller P/E ratios proposed by Campbell and Shiller (1988a), we do not have enough data on EMs to compute these Shiller P/E ratios ourselves.

3.3.1.3 Descriptive statistics

In order to better understand the economic and financial environment in which the 10 largest EM capitalisations evolve, we provide some descriptive statistics in Table 16. On the economic side, we focus on (i) 5-year average real GDP growth, *i.e.*, between 2010 and 2014, (ii) 5-year average inflation, still between 2010 and 2014, (iii) the 2014 PPP GDP per capita and (iv) the 10-year nominal sovereign interest rate. On the financial side, we present only the variables that we are interested in this chapter. We focus on (i) the MSCI indices and (ii) their valuation ratios, *i.e.*, the P/D ratio, the P/B ratio and the P/E ratio. Overall, according to the 2014 PPP GDP per capita and except for Russia, the more developed an EM is, the more its 10-year nominal sovereign interest rate has tended to fall and the more its equity markets have remained stable. *A contrario*, the less developed an EM is, the more its 10-year nominal sovereign interest rate has remained stable and the more its equity market has tended to rise. Concerning the valuation ratios, we note that, for a given EM, the 5-year average of each valuation ratio is about the same order of magnitude for the MSCI index and for the domestic equity index, *cf.* Appendix 3.1. Most importantly, from EM to EM, the 5-year average of each valuation ratio varies quite slightly, which makes these EM valuation ratios broadly comparable. Last but not least, for all valuation ratios and all EMs, the 5-year standard deviation is quite small which means that there is, at this stage and during the last five years, little evidence of long periods of excess valuation and hence potential bubble periods.

Table 16: The economic and financial environment in which the 10 largest EM capitalisations evolve

Note: The table provides information about the economic and financial environment in which the 10 largest EM capitalisations evolve. On the economic side, we focus on (i) 5-year average real GDP growth, *i.e.*, between 2010 and 2014, (ii) 5-year average inflation, still between 2010 and 2014, (iii) the 2014 PPP GDP per capita and (iv) the 10-year nomial sovereign interest rate. On the financial side, we focus on (i) the MSCI indices and (ii) their valuation ratios, *i.e.*, the P/D ratio, the P/B ratio and the P/E ratio. Given that the decriptive statistics are about the same order of magnitude for the MSCI index and for the domestic equity index of a given EM (except for China which is the subject of a full subsection in the next section), we report the descriptive statistics of all the variables that we are interested in this chapter in Appendix 3.1.

Variable		**Country**	China	South Korea	Taiwan	Brazil	South Africa	India	Mexico	Russia	Malaysia	Indonesia
Real GDP growth (5y. avg., in %)			8.5	3.7	4.5	3.3	2.4	6.4 (FY)	3.3	2.8	5.8	5.8
Inflation (5y. avg., in %)			3.2	2.4	1.3	5.9	5.4	9.5	3.9	7.0	2.4	5.5
PPP GDP per capita (in USD)			12,880	35,277	45,854	16,096	13,046	5,855	17,881	24,805	24,654	10,641
10y. nominal sovereign interest rate (in %)												
MSCI (local currency)	Index											
	P/D ratio	5y. avg.	0.35	0.85	0.30	0.26	0.35	0.79	0.70	0.37	0.36	0.42
		5y. std. dev.	0.06	0.08	0.05	0.06	0.04	0.13	0.09	0.16	0.04	0.03
	P/B ratio	5y. avg.	1.74	1.23	1.88	1.50	2.52	2.86	2.87	0.87	2.18	3.76
		5y. std. dev.	0.34	0.18	0.12	0.20	0.16	0.33	0.16	0.21	0.11	0.37
	P/E ratio	5y. avg.	11.29	11.00	17.47	13.11	17.56	17.69	22.22	6.08	16.74	16.72
		5y. std. dev.	2.17	0.76	2.83	1.95	1.87	2.37	2.34	1.33	0.95	1.37

3.3.2 The Generalised Sup ADF test and the date-stamping strategy

In order to clarify the analytical framework to detect rational bubbles in emerging equity markets, we follow the procedure established by Phillips, Shi and Yu (2013a and 2013b, PSY thereafter). They propose to generalize the approach of Phillips *et al.* (2011) to better identify multiple episodes of exuberance and collapse in long time series. Like its predecessor the SADF test, the GSADF test is also based on recursively running right-tailed ADF tests, but the sample sequence is extended to a broader and more flexible range. According to PSY (2013a and 2013b), the GSADF test outperforms the SADF test in detecting multiple episodes of explosive behaviour in short and long time series. Moreover, when formulating the GSADF test, the researchers proposed a new approach to date stamp the origination and termination of rational bubbles.

The basic idea of PSY (2013a and 2013b) is to suppose a Dickey-Füller model which starts from the r_1^{th} and ends at the r_2^{th} fractions of the total sample, $r_2 = r_1 + r_w$ and $r_w > 0$ is the fractional window size of the regression. The estimated model is as follows:

$$\Delta y_t = \hat{\alpha}_{r_1,r_2} + \hat{\beta}_{r_1,r_2} y_{t-1} + \sum_{l=1}^{L} \hat{\psi}^l_{r_1,r_2} \Delta y_{t-l} + \hat{\varepsilon}_t \tag{17}$$

where y_t is one of the three valuation ratios at time t, $\hat{\alpha}_{r_1,r_2}$ is the constant, $\hat{\beta}_{r_1,r_2}$ is the parameter of interest[74], L is the maximum lag order, $\hat{\psi}^l_{r_1,r_2}$ is the lag parameter, $\hat{\varepsilon}_t \overset{iid}{\sim} N\left(0, \hat{\sigma}^2_{r_1,r_2}\right)$ and the number of observations in each regression is $T_w = \lfloor Tr_w \rfloor$ where $\lfloor . \rfloor$ represents the integer part of the argument. The ADF test statistic based on the regression in (16) is denoted by ADF^{r2}_{r1}. The window size r_w extends from r_0 to 1, where r_0 corresponds to the smallest sample window[75]. The GSADF test statistic is defined as the largest ADF statistic in the double recursion over all feasible samples between r_1 and r_2 and is denoted $GSADF(r_0)$:

$$GSADF\left(r_0\right) = \sup_{\substack{r_2 \in [r_0, 1] \\ r_1 \in [0, r_2 - r_0]}} \left\{ ADF^{r_2}_{r_1} \right\} \tag{18}$$

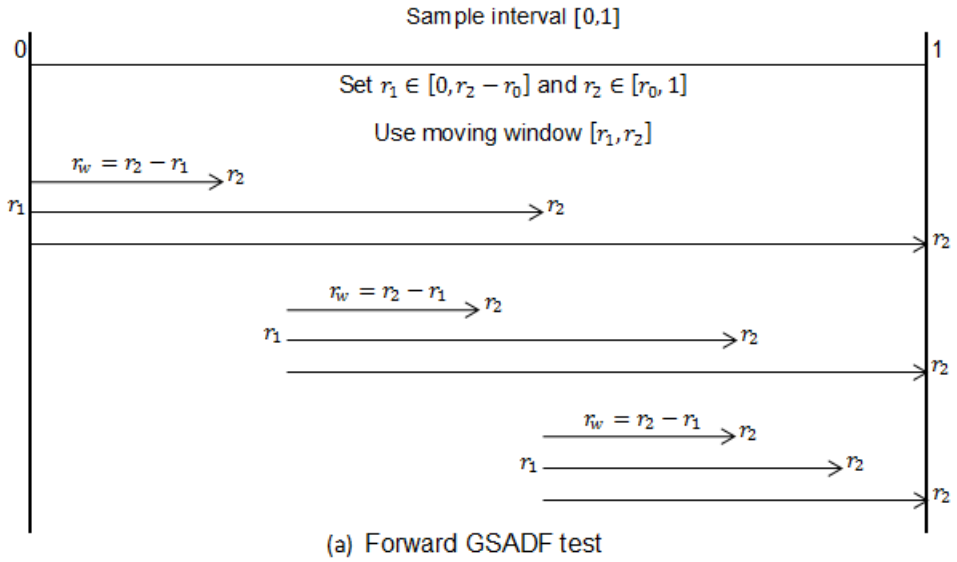
To minimize the risk of finding pseudo stationary behaviour because of multiple col-

[74] The usual null hypothesis of no bubbles $H_0 : \theta = 1$ and alternative hypothesis of explosive bubbles $H_1 : \theta \neq 1$ should be tested. However, according to Phillips and Yu (2011), given that we implement right-tailed ADF tests, the alternative hypothesis which allows for a mildly explosive bubble becomes $H_1 : \theta > 1$.

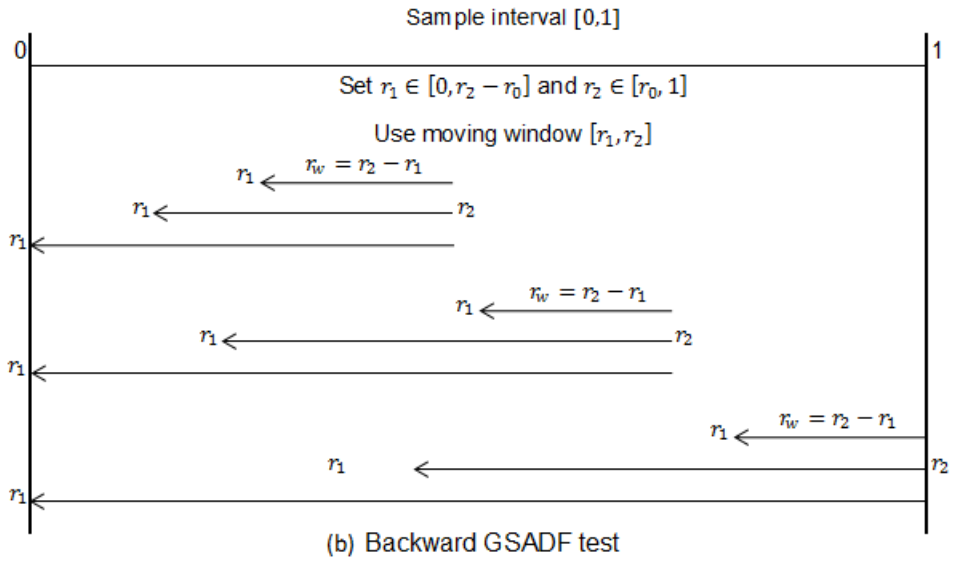
[75] According to extensive simulations conducted by PSY (2013b), a rule for choosing the smallest sample window r_0 is recommended. This rule is based on a lower bound of 1% of the full sample and should be extended to $r_0 = 0.01 + 1.8/\sqrt{T}$, which is convenient for computation. However, PSY (2013a and 2013b) show that using smaller window leads to almost similar results, especially when samples are relatively small.

Figure 8: Forward and backward sample sequences and window widths of the GSADF test

Note: The figures illustrate the sample sequences and window widths used in the recursive forward and backward GSADF test procedures. The window size r_w extends from r_0 to 1, where r_0 corresponds to the smallest sample window. According to extensive simulations conducted by PSY (2013b), a rule for choosing the smallest sample window r_0 is recommended. This rule is based on a lower bound of 1% of the full sample and should be extended to $r_0 = 0.01 + {}^{1.8}/\sqrt{T}$, which is convenient for computation.



(a) Forward GSADF test



(b) Backward GSADF test

lapsing bubbles, PSY (2013a and 2013b) proposed a backward version of the GSADF test to get a better date-stamping strategy[76]. This backward GSADF test statistic $GSADF(r_0)$ is rewritten:

$$GSADF(r_0) = \sup_{r_2 \in [r_0, 1]} \{BSADF_{r_2}(r_0)\} \tag{19}$$

where $BSADF_{r_2}(r_0) = \sup_{r_1 \in [0, r_2 - r_0]} \left\{ADF_{r_1}^{r_2}\right\}$. To better understand how the GSADF test works, we illustrate the various sample ranges included in the forward and backward tests in Figure 8. However, in the remainder of this chapter, we focus only on the BSADF test statistics sequence to locate bubble periods on emerging equity markets[77].

In this new backward procedure, the origination of a bubble denoted r_e is defined as the first observation for which the value of the $BSADF_{r_2}(r_0)$ test exceeds the critical value. Likewise, the collapse of a bubble r_f is defined as the first observation after r_e for which the value of the $BSADF_{r_2}(r_0)$ test falls below the critical value[78].

3.3.3 Lesson from the S&P 500 index

In order to ensure that the GSADF test is one of the most powerful tests in the literature, we consider, as in PSY (2013a), a relatively long historical equity index in which many crisis events are well-known and well-dated, *i.e.*, the S&P 500 index. Thus, we gather monthly data from January 1965 to May 2015 for the P/D ratio of the S&P 500 index[79], via Bloomberg and Datastream databases. In this emblematic case, the total number of observations T is 605 and thus, the minimum window size r_0 is set to 10% of T, *i.e.*, 60 observations. We let the lag order l be chosen by the Modified Bayesian Information Criterion[80] (MBIC thereafter) in every recursive regression in the

[76] If test statistics are computed on forward extending sample sequences, the information set used to perform the test will include all observations from the starting point r_1 to $\lfloor Tr_2 \rfloor$. Given that the available information set is $I_{\lfloor Tr_2 \rfloor} = \{y_1, y_2, ..., y_{\lfloor Tr_2 \rfloor}\}$, if $I_{\lfloor Tr_2 \rfloor}$ contains multiple collapsing bubbles, there is a risk of finding pseudo stationnary behaviour as in Diba and Grossman (1988). Therefore, this new backward procedure should improve the identification accuracy of detecting rational bubbles.

[77] Actually, the backward GSADF test statistic, like the forward one, reflects only the evidence that the considered equity index includes or not some explosive subperiods. In this chapter, we are particularly interested in the periods of exuberance themselves. Importantly, as pointed out by PSY (2013a and 2013b), the new date-stamping strategy may be used as an *ex ante* real-time dating procedure, while the GSADF test is an *ex post* statistic used for analysing a given data set for bubble behaviour. Therefore, the BSADF test statistics sequence, which offers this new date-stamping strategy, is more prone to locate specific bubble periods in emerging equity markets.

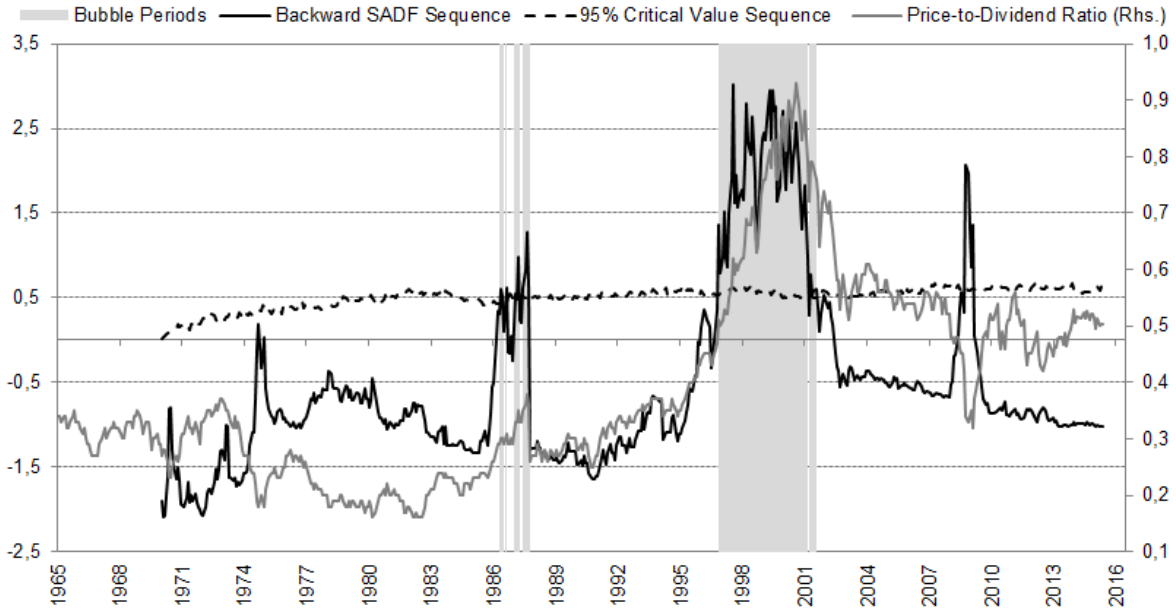
[78] The finite sample critical values are obtained from Monte-Carlo simulations with 2,000 replications.

[79] We also perform the GSADF test and compute the BSADF sequence on the P/B ratio and on the P/E ratio of the S&P 500 index, for which data start respectively in January 1990 and January 1954.

[80] The standard BIC has been criticised for selecting models that are overly parsimonious, especially for small samples. Ng and Perron (2001) conclude that selection rules based on information criteria tend to select values of lag that are too small, which results in significant size distorsions in the usual ADF tests. To circumvent this issue, they proposed a modified version of the standard BIC which performed significantly better in choosing the right number of lags in small

Figure 9: Date-stamping bubble periods in the S&P 500 P/D ratio using the GSADF test

Note: The figure displays results of the date-stamping strategy for the P/D ratio of the S&P 500 index. In this emblematic case, the total number of observations T is 605 and thus, the minimum window size r_0 is set to 10% of T, *i.e.*, 60 observations. We let the lag order l be chosen by the Modified Bayesian Information Criterion (MBIC thereafter) in every recursive regression in the equation (16). The maximum allowed lag L is set to 5. To locate specific bubble periods, we compare the BSADF test statistics sequence with the 95% critical values sequence, which was obtained from Monte-Carlo simulations with 2,000 replications. Although PSY (2013a and 2013b) suggests using a minimum bubble duration of $log\,(T)$ to avoid short-term bubble periods, we represent all episodes of exuberance in the S&P 500 index.



equation (16). The maximum allowed lag L is set to 5. To locate specific bubble periods, we compare the BSADF test statistics sequence with the 95% critical values sequence, which was obtained from Monte-Carlo simulations with 2,000 replications. Figure 9 displays results of the date-stamping strategy for the P/D ratio of the S&P 500 index.

From Figure 9, the identified periods of exuberance in the S&P 500 index include Black Monday in October 1987 (from May 1985 to September 1987), the dot-com bubble (from November 1996[81] to July 2001) and the global financial crisis (from October 2008

samples. Given that some of the recursive regressions in the GSADF test will be computed using very small samples, we will use the MBIC to choose the optimal lag in every regression.

[81] On December 5, 1996, Alan Greenspan, the then Federal Reserve Board chairman, used the term "irrational exuberance" for the first time in a speech given at the American Enterprise Institute. This term was interpreted as a warning that the market might be somewhat overvalued. Moreover, it is interesting to note that the BSADF sequence identifies

to February 2009). In the latter case and in contrast to the two previous cases, we can see that this exuberant period was characterised by a sudden and significant drop in the P/D ratio without having been preceded by explosive behaviour in this same valuation ratio.[82]. Therefore, we do not hold this period as a bubble period. Given that the identication of crashes as bubbles may be caused by very rapid changes in the data, we assume that bubble periods may be caused only by upward exuberant behaviour and this applies to all valuation ratios studied throughout this chapter.

3.4 The historically low real interest rates lead to portfolio rebalancing effects ... not inevitably to bubbles

In response to the global financial crisis of 2007-08 and the Great Recession that followed, the Federal Reserve has considerably eased its monetary policy by lowering its key interest rates and through successive rounds of QE. Its developed counterparts, *i.e.*, the Bank of England, the Bank of Japan and the European Central Bank, did the same during the following months and years. More recently, the PBoC joined its developed counterparts in boosting liquidity to address weakening growth, promote credit expansion and recapitalise its equity markets. The very accommodative and unconventional monetary policies undertaken by the major central banks in recent years have exacerbated the downward pressure on interest rates and have led to very rapid and strong growth of global liquidity. This global excess liquidity has led investors to search for yield by turning towards higher-return, and therefore riskier, assets. Although the responsibility of central banks in global excess liquidity that has fed speculative bubbles in the DMs has often been mentioned, it is not trivial that the same phenomenon occurred in EMs. Indeed, in a global economy with a structurally high savings rate, low employment rate and where the global excess liquidity has relatively no impact on the prices of goods and services, we may wonder if there are some excess valuations, or even some bubble periods, in the emerging equity markets. The recent case of the Chinese bubble bursting will undergo a more thorough approach.

3.4.1 Testing for multiple bubbles in emerging equity markets

Here, we apply the GSADF test on the three valuation ratios, *i.e.*, the P/D ratio, the P/B ratio and the P/E ratio, of the S&P 500 index and the 10 largest EM capi-

the beginning of the dot-com bubble at about the same date, even one month before.

[82] Also, we can see that the P/D ratio falls very rapidly during the 1973 oil shock and the BSADF sequence is able to capture this sudden regime switching. Neverthless, according to the GSADF test, we do not retain this period of relative exuberance as a bubble period.

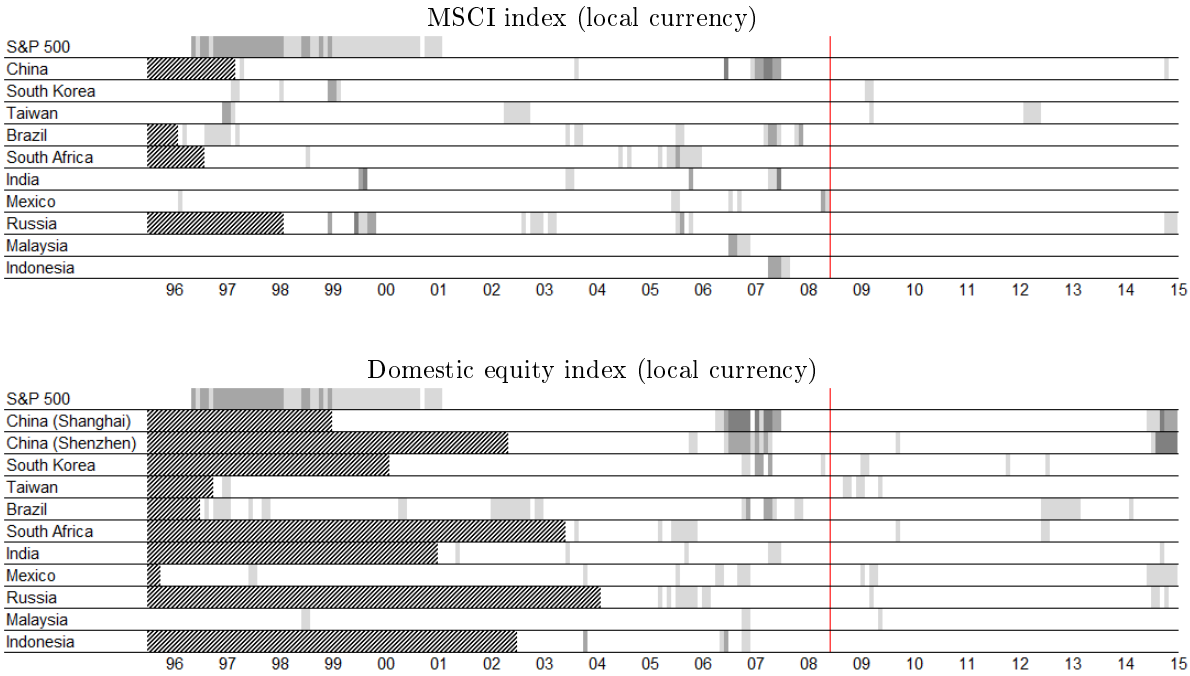
talisations. The total number of observations T ranges between 137 and 281 for EMs and thus, the minimum window size r_0 is set to 10% of T, *i.e.*, ranges between 14 and 28 observations. We let the lag order l be chosen by minimising the MBIC in every recursive regression in the equation (5). The maximum allowed lag L is set to 5. To locate specific bubble periods, we compare the BSADF test statistics sequence with the 95% critical values sequence, which was obtained from Monte-Carlo simulations with 2,000 replications. As stated above, we focus more specifically on the BSADF sequence to date-stamp the main bubble periods of these equity indices and we are interested in bubble periods which may have been caused only by an upward exuberant behaviour. Although the BSADF sequence is able to identify periods of financial crises in an *ex post* fashion, we do not hold these periods in this chapter. Through this *ex ante* procedure, we are able to date-stamp both past bubbles and real-time bubbles. Basically, the idea is to test if the environment of historically low real interest rates and the subsequent search for yield lead to bubbles in emerging equity markets or merely to some portfolio rebalancing effects. In the latter case, the valuation ratios studied in this chapter would experience some significant increases without leading to speculative bubbles.

Figure 10 shows the bubble periods according to the date-stamping procedure provided by the BSADF sequences. The hatched periods correspond to the periods for which the data are not available. The darker the grey, the more the period has to be considered as a bubble period. More precisely, light grey denotes that only one valuation ratio is considered in a bubble period, medium grey denotes that two valuation ratios are considered in a bubble period while dark grey denotes that all three valuation ratios are considered in a bubble period. Lastly, the vertical line represents the start of the first round of the Federal Reserve QE, *i.e.*, in late November 2008, which corresponds to a breaking point both in macroeconomic and monetary policy terms.

From Figure 10, we see that emerging equity markets have faced a few short bubble periods, *e.g.*, the 1997 Asian financial crisis, the 1998 Russian crisis, partly connected to the previous one, the 2007 and then the 2015 Chinese bubbles. Concerning the 1997 Asian crisis, this crisis period begins in July 1997 with the financial collapse of the Thai baht and raised fears of a worldwide economic meltdown due to financial contagion. As the crisis spread, most of Southeast Asia and Japan saw slumping currencies, devalued stock markets and other asset prices, and a precipitous rise in private debt. Outside Asia, Brazil has also known some troubles. According to the BSADF sequence, South Korea, Taiwan, Brazil and to a lesser extent China experienced some exuberant be-

Figure 10: Results of the date-stamping procedure

Note: The figures show the bubble periods according to the date-stamping procedure provided by the BSADF sequences. We report the results for the S&P 500 index followed by the MSCI and domestic equity indices of the 10 largest EM capitalisations. The hatched periods correspond to the periods for which the data are not available. The darker the grey, the more the period has to be considered as a bubble period. More precisely, light grey denotes that only one valuation ratio is considered in a bubble period, medium grey denotes that two valuation ratios are considered in a bubble period while dark grey denotes that all three valuation ratios are considered in a bubble period. Lastly, the vertical line represents the start of the first round of the Federal Reserve QE, *i.e.*, in late November 2008, which corresponds to a breaking point both in macroeconomic and monetary policy terms.



haviours between mid 1997 and the end of 1997. Regarding the 1998 Russian crisis, the BSADF sequence is not able to detect the financial bubble of 1998 because of missing data. However, the BSADF sequence highlights a bubble behaviour between June 1999 and April 2000. We explain this exuberant period by the fact that, following the rapid recovery induced by the strong rise in oil prices, the Russian equity markets' valuation ratios became very high and suddenly fell in the wake of oil prices. Still in the case of Russia, we see a more recent bubble period which we also explain by the fall in oil prices in a highly uncertain macroeconomic environment. The bubble periods we have just mentioned were relatively brief and on a small scale compared to the 2007 Chinese bubble. Indeed, the 2007 Chinese bubble bursts on February 27, 2007 when the Shanghai Composite index tumbled 9%, the largest drop in 10 years. The plunge in Asian equity markets sent ripples through the world market. The 2007 Chinese bubble bursting triggered drops and major unease in nearly all financial markets around the world. According to the BSADF sequence, the 2007 Chinese bubble starts in October 2006, intensifies in December 2006, bursts in February 2007 and ends at the end of 2007. Most Asian EMs saw their equity markets plunge in the wake of the Chinese equity markets. It was notably the case for South Korea, India, Malaysia and Indonesia but not necessarily at the same time.We investigate with more granularity the 2015 Chinese bubble in the next section.

Overall, according to the results of the date-stamping procedure used in this chapter, we can argue that global excess liquidity spawned by the historically low real interest rates did not result in emerging equity market bubbles. Indeed, apart from China, since late November 2008 and the launch of the first round of the Federal Reserve QE, the emerging equity markets have experienced fewer exuberant periods than before the use of unconventional monetary polices by the major central banks. Consequently, investors' search for yield has created some huge portfolio rebalancing effects towards EMs, and more specifically towards emerging equity markets. These portfolio rebalancing effects have had strong upward pressures on emerging equity markets but they have not yet created rational bubbles.

3.4.2 The 2015 Chinese bubble bursting

The 2015 Chinese crash began with the bursting of the equity market bubble during the week of June 15 to 19, 2015 with a cumulative plunge of 11.5%. By July 8, 2015,

a third of the value of A-shares[83] on the Shanghai Stock Exchange was lost within one month of the event. Major aftershocks occurred around July 27 and August 24. In the year leading up to the crash, encouraged by state-owned media, enthusiastic individual investors inflated the stock market bubble through massive amounts of investments in equities often using borrowed money, exceeding the rate of economic growth and profits of the companies in which they were investing. Investors faced margin calls on their equities and many were forced to sell off shares in droves, precipitating the crash. Values of Chinese equity markets continued to drop despite efforts by the government to reduce the fall. After three stable weeks, the Shanghai Composite index fell again on July 27 and August 24, 2015 by 8.5%, marking the two largest falls since 2007. There were additonal losses of 7.6% on August 25, 2015.

The effects of the 2015 Chinese bubble bursting on world equity markets were devastating. The MSCI World index, which takes into account only the developed equity markets, lost nearly 11% between June 15 and August 24, 2015. Its emerging counterpart plunged by more than 16% over this same period. The Chinese government enacted many measures to stem the tide of the crash. Regulators limited short selling under threat of arrest. Large mutual funds and pension funds pledged to buy more stocks. The government stopped initial public offerings. The authorities also provided cash to brokers to buy shares, backed by PBoC cash. Because the Chinese markets mostly comprise individuals and not institutional funds (80% of investors in China are individuals), state-run media continued to persuade its citizens to purchase more equities. In addition, the China Securities Regulatory Commission imposed a six-month ban on stockholders owning more than 5% of a company's stock from selling those stocks, resulting in a 6% rise in equity markets. Further, around 1,300 total firms, representing 45% of the stock market, suspended the trading of stocks starting on July 8, 2015. Forbes contributor Jesse Colombo contended that the measures undertaken by the Chinese government, along with cutting the interest rate, "allowing the use of property as collateral for margin loans, and encouraging brokerage firms to buy stocks with cash from the PBoC" caused Chinese stocks to begin surging in mid-July. He argued that in general, however, the outcomes of government intervention as it relates

[83] In China, there are two stock exchanges, one in Shanghai and the other in Shenzhen. Both have A- and B- share markets. The key distinction is that A-shares are denominated in renminbi and B-shares in foreign currency (USD in Shanghai and Hong Kong dollars in Shenzhen, also known as H-shares). For a long time, the other main difference between the two types of shares, from a regulatory standpoint, was that the A-share market was closed to foreign investors while the B-share market was open only to foreigners. However in 2001, the Chinese authorities tried to boost the B-share market by opening it to individual Chinese investors. And in 2003, a scheme was introduced whereby select foreign institutions were allowed to buy A-shares. Some companies have their stocks listed on both boards, but their B-shares trade at a large discount to their A-shares, which tend to see much larger trading volumes.

to the crash will, by its nature, be difficult to predict, but said that in the longer term, the effect may be the development of an even larger bubble through creation of a moral hazard. On August 11, 2015, two months after the crash, the PBoC devalued the renminbi by 1.8% to CNY 6.32 per USD. On August 14, 2015, the central bank devalued it again to CNY 6.40 per USD. As of August 30, the Chinese government arrested 197 people, including journalists and stock market officials, for "spreading rumours" about the stock market crash. The government officials accused "foreign forces" of "intentionally [unsettling] the market" and planned a crackdown on them.

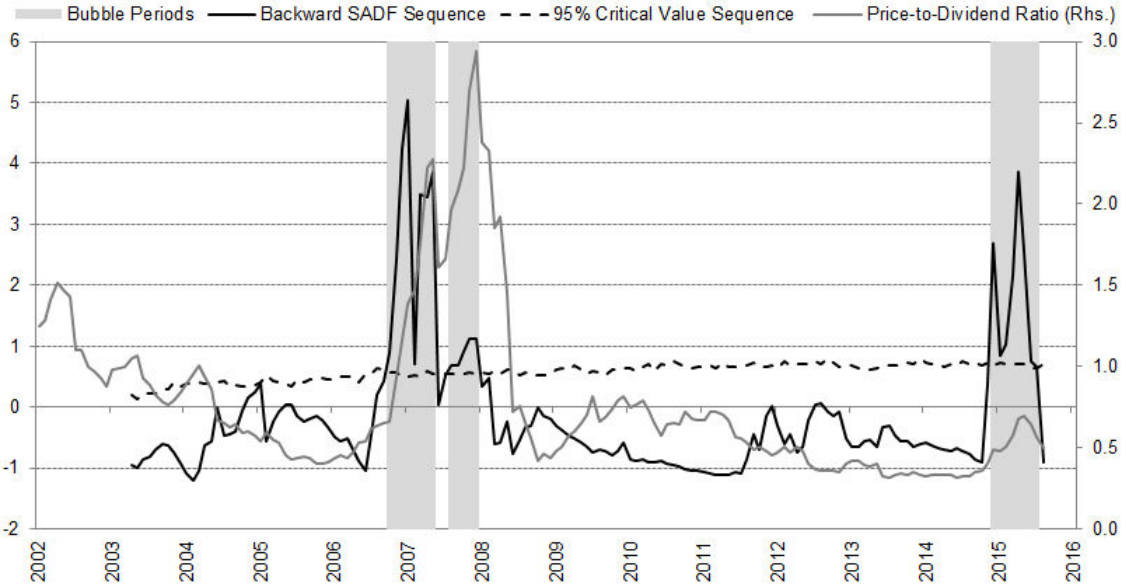
Concerning the identification of this bubble period with the BSADF sequence, we start by slightly extending the sample period up to August 2015. For the P/D ratios of the Shanghai Composite and Shenzhen Composite indices, we hold a sample period which starts in January 2002 while for the MSCI index, the sample period for the P/D ratio starts in October 1995. Consequently, the total number of observations T ranges between 164 and 239 and thus, the minimum window size r_0 is set to 10% of T, *i.e.*, ranges between 16 and 24 observations. We let the lag order l be chosen by minimising the MBIC in every recursive regression in the equation (5). The maximum allowed lag L is set to 5. The results of the BSADF sequence for these three P/D ratios are reported in Figure 11 and 12.

According to the date-stamping procedure provided by the BSADF sequence on the P/D ratios of the two domestic equity indices, which is reported in Figure 11, the bubble period starts in December 2014, intensifies in April and May 2015, bursts in June 2015 and ends at the end of July 2015. The results for the two other valuation ratios, *i.e.*, the P/B ratio and the P/E ratio, argue in favour of exuberant behaviour during this same period but the starting and ending points of the bubble period vary slightly. Concerning the results of the date-stamping procedure on the P/D ratio of the MSCI index, which is reported in Figure 12, the only point which argues in favour of exuberant behaviour is identified in April 2015, when the bubble period intensifies according to the results of Figure 11. This difference in readings is mainly due to the different composition of the MSCI index, which includes only tradable equities by foreign investors. In light of these results, we can argue that the 2015 Chinese bubble was more a domestic crisis than a worldwide one. As of the end of August 2015, although the decline in the Chinese domestic equity markets may continue, a large part of the correction has already occurred in these markets.

Figure 11: Results of the date-stamping procedure for the P/D ratios of the two domestic equity indices

Note: The figures show the 2015 Chinese bubble period according to the date-stamping procedure provided by the BSADF sequences. We report the results for the P/D ratios of the two domestic equity indices, *i.e.*, the Shanghai Composite and Shenzhen Composite indices. The bubble period starts in December 2014, intensifies in April and May 2015, bursts in June 2015 and ends at the end of July 2015.

Shanghai Composite index



Shenzhen Composite index

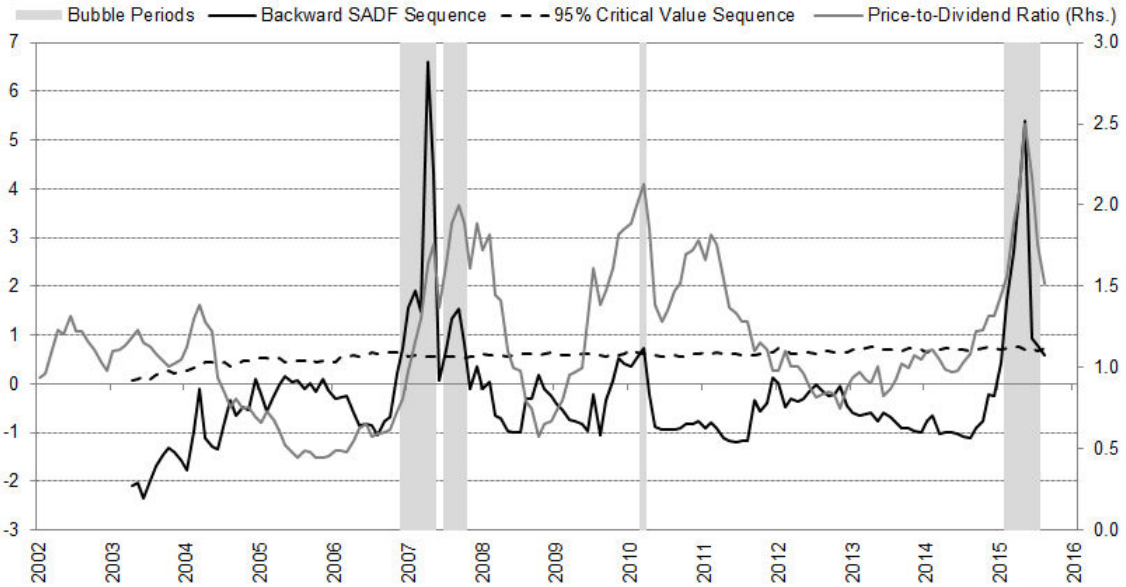
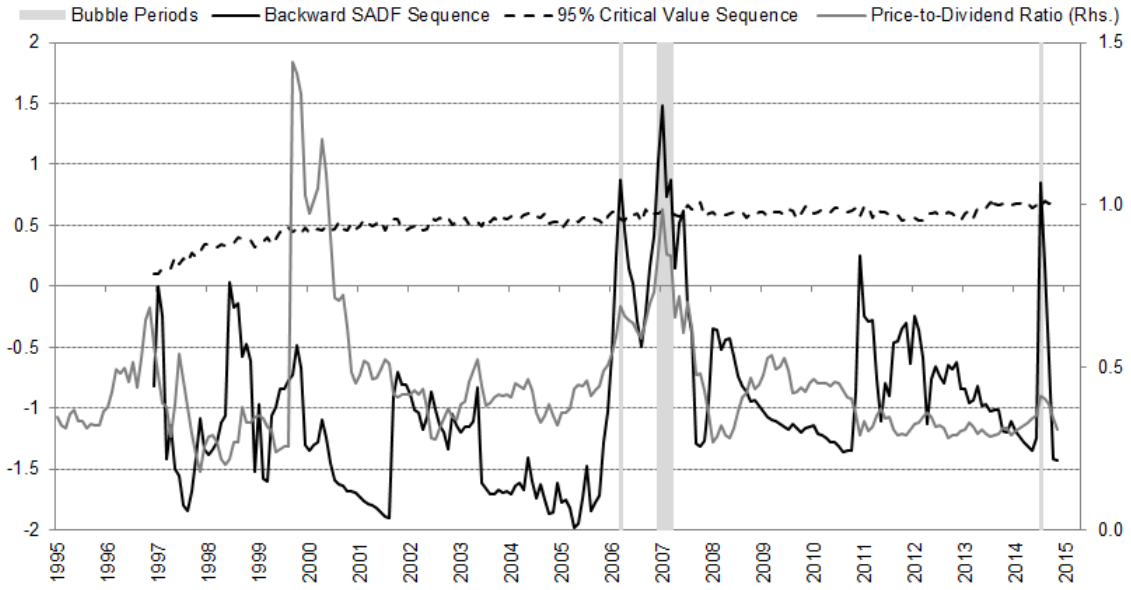


Figure 12: Results of the date-stamping procedure for the P/D ratios of the MSCI index

Note: The figures show the 2015 Chinese bubble period according to the date-stamping procedure provided by the BSADF sequences. We report the results for the P/D ratio of the MSCI index. The only point which argues in favour of exuberant behaviour is identified in April 2015, when the bubble period intensifies according to the results reported in Figure 11. This difference in readings is mainly due to the different composition of the MSCI index, which includes only tradable equities by foreign investors.



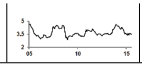
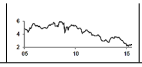
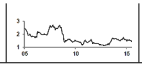
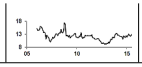
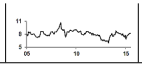
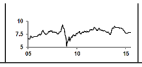
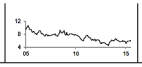
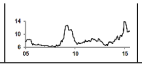
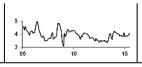
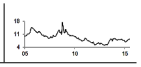
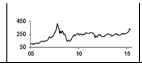
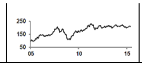
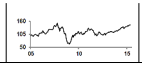
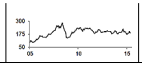
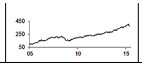
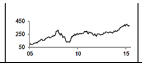
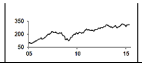
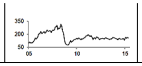
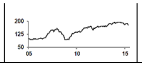
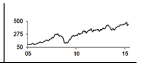
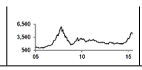
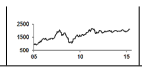
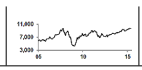
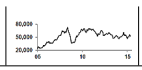
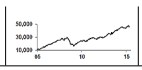
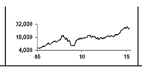
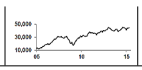
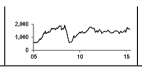
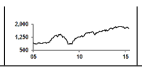
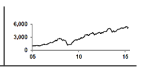
3.5 Conclusion

The new world of historically low real interest rates has led investors to search for yield by turning towards higher-return, and therefore riskier, assets. In this chapter, we have examined if the low real interest rates and the subsequent search for yield have led to bubbles in emerging equity markets or merely to some portfolio rebalancing effects. After having reviewed the vast literature on empirical tests for asset price bubble detection, we used one of the most powerful tests to date, *i.e.*, the GSADF test proposed by Phillips *et al.* (2013a and 2013b). More precisely, we studied the BSADF sequence on the three most used valuation ratios for equity markets to date-stamp the bubble periods.

Overall, in this "New Normal" environment, investors' search for yield has created some huge portfolio rebalancing effects towards EMs, and more specifically towards emerging equity markets. These portfolio rebalancing effects have had strong upward pressures on emerging equity markets but they have not yet created rational bubbles. Indeed, according to the results of the BSADF sequences on the 10 largest EM capitalisations, we find no clear evidence advocating for bubbles in these emerging equity markets, except for China where a domestic bubble burst during summer 2015. We therefore argue that global excess liquidity and the search for yield have inflated emerging equity markets. In the post-Lehman era, the EMs are experiencing a new valuation regime in which the valuation ratios are structurally higher. Lastly, in light of our results, this new valuation regime does not seem, for the time being, irrational.

Appendix 3.1: The economic and financial environment in which the 10 largest EM capitalisations evolve

Note: The table provides information about the economic and financial environment in which the 10 largest EMs capitalisations evolve. On the economic side, we focus on (i) 5-year average real GDP growth, *i.e.*, between 2010 and 2014, (ii) 5-year average inflation, still between 2010 and 2014, (iii) the 2014 PPP GDP per capita and (iv) the 10-year nomial sovereign interest rate. On the financial side, we focus on (i) the MSCI indices and (ii) the domestic equity indices and (iii) their respective valuation ratios, *i.e.*, the P/D ratio, the P/B ratio and the P/E ratio. In the case of the Chinese domestic equity indices, we report only the descriptive statistics of the Shanghai Composite index because it is larger than the Shenzhen Composite index.

Variable		**Country**	China	South Korea	Taiwan	Brazil	South Africa	India	Mexico	Russia	Malaysia	Indonesia
Real GDP growth (5y. avg., in %)			8.5	3.7	4.5	3.3	2.4	6.4 (fiscal years)	3.3	2.8	5.8	5.8
Inflation (5y. avg., in %)			3.2	2.4	1.3	5.9	5.4	9.5	3.9	7.0	2.4	5.5
PPP GDP per capita (in USD)			12,880	35,277	45,854	16,096	13,046	5,855	17,881	24,805	24,654	10,641
10y. nominal sovereign interest rate (in %)												
MSCI (local currency)	Index											
	P/D ratio	5y. avg.	0.35	0.85	0.30	0.26	0.35	0.79	0.70	0.37	0.36	0.42
		5y. std. dev.	0.06	0.08	0.05	0.06	0.04	0.13	0.09	0.16	0.04	0.03
	P/B ratio	5y. avg.	1.74	1.23	1.88	1.50	2.52	2.86	2.87	0.87	2.18	3.76
		5y. std. dev.	0.34	0.18	0.12	0.20	0.16	0.33	0.16	0.21	0.11	0.37
	P/E ratio	5y. avg.	11.29	11.00	17.47	13.11	17.56	17.69	22.22	6.08	16.74	16.72
		5y. std. dev.	2.17	0.76	2.83	1.95	1.87	2.37	2.34	1.33	0.95	1.37
Domestic (local currency)	Index											
	P/D ratio	5y. avg.	0.47	0.78	0.30	0.25	0.35	0.68	0.68	0.35	0.30	0.49
		5y. std. dev.	0.13	0.08	0.05	0.03	0.05	0.06	0.11	0.14	0.03	0.04
	P/B ratio	5y. avg.	1.82	1.09	1.70	1.35	2.28	2.83	2.73	0.84	2.25	2.82
		5y. std. dev.	0.43	0.11	0.10	0.24	0.14	0.28	0.23	0.22	0.10	0.23
	P/E ratio	5y. avg.	13.26	17.47	17.86	52.65	16.55	17.80	22.59	6.74	16.34	19.61
		5y. std. dev.	3.02	5.27	3.13	86.53	3.35	1.99	3.03	1.24	0.79	2.02

Conclusion Générale

L'ascension des ME lors des deux dernières décennies s'est parfois accompagnée d'instabilité économique et financière. Par ailleurs, au-delà de l'intégration commerciale, l'accroissement marqué de l'intégration financière des ME (Garcia-Herrero et Wooldridge, 2007) donne un caractère contagieux et systémique à ces déséquilibres (Rejeb et Boughrara, 2015). Nous proposons d'aborder de manière empirique certaines des problématiques relativement récentes induites par ces déséquilibres. La plus grande disponibilité des données macroéconomiques et financières sur les ME offre davantage de possibilités aux chercheurs désireux d'étudier ces problématiques. Cette thèse s'insère dans ce contexte et contribue à la littérature portant sur l'excès de liquidité mondiale induit par la montée en puissance des politiques monétaires non conventionnelles et sur ses impacts sur les prix des actifs des ME, notamment *via* le canal des investissements de portefeuille.

Dans le premier chapitre, nous avons analysé les impacts de l'excès de liquidité mondiale sur les prix des actifs des BRICS. Nous avons commencé par construire trois agrégats d'excès de liquidité mondiale basés sur les réserves de change, la masse monétaire et le crédit domestique. En accord avec la littérature existante (Gouteron et Szpiro, 2005 ; Brana *et al.*, 2012), nous avons ensuite estimé les interactions qui pouvaient exister entre l'excès de liquidité mondiale, l'activité économique et les prix des actifs des BRICS. Globalement, nos résultats montrent que l'excès de liquidité mondiale (i) a fait grimper significativement les prix des actions, (ii) a fait s'apprécier les devises des BRICS, que ce soit en termes effectifs réels mais aussi contre USD, (iii) a fait baisser les taux d'intérêt souverains à long terme, résultant en une relative compression des *spreads* par rapport aux États-Unis. En outre, nous avons constaté que l'accumulation de réserves de change, mesure la plus représentative de ce que nous avons appelé le premier régime d'excès de liquidité mondiale, affecte les prix des actifs mentionnés ci-dessus dans le sens attendu dans près de deux tiers des cas. En ce qui concerne l'agrégat d'excès de liquidité mondiale basé sur la masse monétaire, mesure la plus représentative de ce que nous avons appelé le second régime d'excès de liquidité mondiale, ce dernier affecte les

prix de ces mêmes actifs dans le sens attendu dans près de quatre cas sur dix alors que ce ratio baisse à environ un tiers pour l'agrégat d'excès de liquidité mondiale construit avec le crédit domestique. En outre, ce sont les actifs brésiliens, russes et indiens qui ont été les plus touchés par l'excès de liquidité mondiale, et ce, quel que soit le régime d'excès de liquidité mondiale. Concernant la Chine, la croissance du crédit domestique et de la masse monétaire reflète une certaine forme d'excès quant à la promotion de l'endettement et à la monétisation du système financier par les autorités chinoises, notamment afin de contrôler leur taux de change, actif sur lequel l'excès de liquidité mondiale n'a pas eu d'impact significatif.

Dans le deuxième chapitre, nous avons modélisé un indicateur simple et coïncidant des investissements de portefeuille bruts de la BdP en direction des ME, grâce aux données disponibles *via* EPFR, et ce, dans un contexte de recherche de rendement accru de la part des investisseurs internationaux. En s'appuyant sur cet indicateur, nous avons ensuite construit des indices de sentiment des investisseurs qui fournissent des informations pertinentes sur les rendements des marchés obligataires et d'actions émergents. Notre indicateur simple et coïncidant basé sur les données EPFR contribue à la littérature empirique sur l'approximation des investissements de portefeuille et vise à simplifier le cadre existant (Miao et Pant, 2012). Dans l'ensemble, cet indicateur contourne les faiblesses des données de la BdP, *i.e.*, il est disponible à plus haute fréquence et avec un retard de publication négligeable par rapport aux données de la BdP. En sus de ces avantages, une augmentation des investissements de portefeuille tels qu'ils sont disponibles *via* EPFR est toujours positivement et significativement associée à une augmentation des investissements de portefeuille de la BdP. Par ailleurs, cet indicateur est utile pour approximer les investissements de portefeuille de la BdP pour les agrégats régionaux émergents ainsi que pour les plus grands ME considérés dans ce deuxième chapitre. D'un point de vue plus pratique, les données disponibles *via* EPFR peuvent être étudiées avec davantage de granularité, *e.g.*, domiciliation des flux, type de fonds, type d'investisseurs, allocation sectorielle, devise, etc. Cette grande diversité de ventilation fait de la base de données EPFR un candidat pratique pour les décideurs politiques et pour l'industrie de la gestion d'actifs qui ont besoin, tous deux, de données plus fréquentes, plus spécifiques et disponibles plus rapidement pour améliorer leur compréhension des évolutions les plus récentes des investissements de portefeuille.

Dans le troisième et dernier chapitre de cette thèse, nous avons examiné si la faiblesse historique des taux d'intérêt réels et la recherche de rendement induite ont pu con-

duire à des bulles sur les marchés d'actions émergents ou plus simplement à des effets de réallocation des portefeuilles. Pour ce faire, nous avons retenu un des tests statistiques les plus récents et les plus puissants à ce jour, *i.e.*, le test GSADF (Phillips *et al.*, 2013a et 2013b). Grâce à l'étude des séquences BSADF simulées dans le cadre du test GSDAF, nous avons pu repérer et dater précisément les périodes de bulles sur les marchés d'actions émergents. De manière générale, dans cet environnement qualifié de « Nouvelle Normale », nous avançons des preuves solides selon lesquelles la recherche de rendement initiée par les investisseurs internationaux a créé de larges effets de réallocation des portefeuilles, principalement vers les ME. Ces effets de réallocation des portefeuilles se sont traduits par de fortes pressions haussières sur les marchés d'actions émergents, mais ils n'ont pas pour autant créé de bulles sur ces même marchés, tout du moins dans la période récente. En effet, selon les résultats des séquences BSADF portant sur les dix plus grandes capitalisations boursières émergentes, nous ne trouvons pas d'argument clair plaidant pour la formation de bulles sur ces dix marchés d'actions émergents, exception faite de la Chine, où une bulle domestique a éclaté pendant l'été 2015. Par conséquent, nous soutenons l'idée selon laquelle l'excès de liquidité mondiale qui s'est déversé dans les ME s'est traduit par un gonflement des prix des marchés d'actions émergents. En conclusion, dans l'ère post-Lehman, il semble que les ME soient peu à peu rentrés dans un nouveau régime de valorisation dans lequel les ratios de valorisation d'équilibre sont plus élevés qu'auparavant. Enfin, à la lumière de ces résultats, ce nouveau régime de valorisation ne nous semble pas, pour le moment, « irrationnel ».

Les résultats mis en évidence à travers cette thèse nous permettent de mettre en lumière plusieurs pistes de recherche. Etant donné que certaines notions abordées dans ce travail de recherche font appel à des *proxies*, de simples changements de mesures pourraient rendre plus robustes certaines des conclusions avancées dans cette thèse. Par exemple, la notion d'excès de liquidité mondiale, définie et utilisée ici au sens monétaire du terme, pourrait trouver une certaine forme de résonance dans certains agrégats plus microéconomiques et notamment à travers des mesures de liquidité de marché, *e.g.*, *spread bid-ask*, volume de transactions, taux d'intérêt réel à court terme, etc. En effet, la liquidité monétaire et la liquidité de marché sont deux notions proches qui peuvent interagir de manière coordonnée, notamment par le canal du crédit domestique (Glocker et Towbin, 2013). Par ailleurs, le cadre de recherche de notre premier chapitre sur les impacts de l'excès de liquidité mondiale sur les prix des actifs des BRICS pourrait

être étendu à davantage de pays émergents, aux pays développés ou encore à d'autres classes d'actifs comme l'immobilier et le crédit aux entreprises. Concernant l'utilisation des données EPFR, ces dernières ont, au-delà de leur caractère coïncidant avec les investissements de portefeuille bruts de la BdP, des avantages quant à leur disponibilité. En effet, leur publication fréquente et quasiment en temps réel en font un sérieux candidat pour remplacer les investissements de portefeuille bruts de la BdP, notamment dans l'étude d'envolées (*surges*) et/ou d'arrêts brutaux (*sudden stops*), pouvant créer des déséquilibres macroéconomiques et financiers dans les ME. De plus, les investissements de portefeuilles disponibles *via* EPFR pourraient faire l'objet d'une modélisation multifactorielle, *e.g.*, facteurs *push* et *pull*. Enfin, de nouvelles questions se posent : de futures recherches pourraient se concentrer sur l'étude des effets de réallocation des portefeuilles sur les prix des actifs des ME dans l'environnement actuel qualifié de « Nouvelle Normale », caractérisé notamment par la faiblesse historique des taux d'intérêt réels. Ces effets de réallocation des portefeuilles pourraient, de par leur rapidité et leur brutalité, induire des bulles sur les marchés d'actions émergents mais aussi sur leurs homologues développés ou encore sur certains marchés immobiliers en pleine croissance.

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Résumé

Cette thèse tente d'analyser qualitativement et quantitativement les impacts, parfois déstabilisateurs, de l'excès de liquidité mondiale sur les prix des actifs des marchés émergents. Cet excès de liquidité mondiale s'est notamment matérialisé par un essor des investissements de portefeuille vers les marchés émergents, essor dont l'étude est devenue un thème central que ce soit pour les décideurs politiques ou pour l'industrie de la gestion d'actifs. A ce titre, nous nous proposons de contourner les faiblesses des données de la Balance des Paiements en construisant un indicateur non-retardé et à haute fréquence des flux de portefeuille, et ce, grâce aux données EPFR. La dynamique de recherche de rendement induite par la mise en place de politiques monétaires non conventionnelles par les principales banques centrales des marchés développés a eu pour effet une forte inflation des prix des actifs, au premier rang desquels figurent les marchés d'actions émergents, marchés sur lesquels de potentielles bulles ont pu faire leur apparition dans la période qualifiée de « Nouvelle Normale ».

Mots Clés

Marchés Emergents, Excès de Liquidité Mondiale, Investissements de Portefeuille, Prix des Actifs, BRICS, EPFR, Nouvelle Normale, Bulles, Cointégration, Test GSADF.

Abstract

This thesis aims to qualitatively and quantitatively analyse the sometimes destabilising impacts of global excess liquidity on emerging markets asset prices. This global excess liquidity has particularly manifested in a rise in portfolio capital flows towards emerging markets. The study of this rise has become a central topic both for policymakers and asset managers. As such, we propose to circumvent the Balance of Payments weaknesses by building a non-lagging and high frequency indicator of portfolio capital flows using the data provided by EPFR. The search for yield trend caused by the unconventional monetary policies undertaken by the main developed markets central banks has caused significant inflation in asset prices, most prominently in emerging equity markets, where potential bubbles have appeared during the so-called “New Normal” period.

Keywords

Emerging Markets, Global Excess Liquidity, Portfolio Capital Flows, Asset Prices, BRICS, EPFR, New Normal, Bubbles, Cointegration, GSADF Test.

Numéro national de thèse :